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ABSTRACT

This document contains the appendixes to a publication by the Higher Education Funding Council for England (HEFCE), "Business Model for the E-University: A Report to the HEFCE by PricewaterhouseCoopers." The four appendixes are: (1) "Examples of E-Initiatives in Higher Education"; (2) "Options for the Corporate Structure of the E-University"; (3) "Learning Products and Services" (learning materials and the learning environment, production of learning materials, commissioning of courseware, and supporting online learning); and (4) "Technology Aspects" (e-learning technology, e-university operations, and Internet trends). A list of acronyms is also provided. (SM)

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October 00/44b
Report
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Business model for the e-University: annexes

Report to the HEFCE by PricewaterhouseCoopers

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Business model for the e-University: annexes

This document contains the annexes to HEFCE publication 00/44a: 'Business model for the e-University: a report to the HEFCE by PricewaterhouseCoopers'.

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Copies of both publications, and the HEFCE's consultation on the proposals for the e-U business model (HEFCE 00/43) are available from:

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Annex 1

Examples of e-initiatives in higher education

1. Perhaps the most comprehensive e-development within the UK is Scottish Knowledge, set up by a group of Scottish universities and UK businesses to act as a commercial and global marketing partner. Its launch in early 1999 has been followed by the pragmatic development of materials, with opportunities for the partner universities and a marketing presence in key markets. It operates a model of modular programmes built from multi-source suppliers in order to provide tailor-made solutions to clients. This has some similarities with our proposals for the e-U.

2. Aiming at a different market, with a focus on the UK home market, is the University for Industry (UfI) which is establishing the 'learndirect' information, advice and e-learning network through a series of locally supported hubs. UfI is aimed at vocational skilling with a focus on particular skill areas (eg basic skills) and for particular industries. Most of these are further education level and are offered by host colleges and learning centres. This should therefore complement the e-U.

3. Another example with a UK base is Universitas 21 which has a network of 18 universities in 10 countries designed to pursue education agendas that would be beyond their individual capabilities. As an incorporated entity, Universitas 21 is able to build on the reputation and resources of its members and those of its corporate partners. The target market encompasses professional adult learners. The programmes will be aimed at graduates already in the workforce.

4. Unext, with its headquarters in the US, is working with a consortium of universities – including the London School of Economics and four prestigious US universities – to provide business courses through the newly formed Cardean University. It plans to use the Internet to create a learner-centric environment that is personalised and interactive. Unext works with academics to capture their knowledge in an on-line environment and has invested $100m in course development before enrolling any students. Its market focus is on continuing education for working adults and for corporations, at least in part to protect the consortium members' current markets from encroachment by others in distance learning.

5. An interesting development is The Open University of Catalonia (UOC) based in Barcelona. Launched in 1996 to a pilot market aimed at one programme, it has grown to 20,000 students and 16 on-line courses, all completely virtual, at bachelor, master and doctorate levels. It covers Spain and the Spanish-speaking Americas and will soon also provide broader English language offerings globally. The UOC business model is a public private partnership operating with a network of spin-off businesses and joint ventures funded by a mix of state and private capital. It has invested significantly in a technology platform that it 'lends' to appropriate spin-offs for a fee. It uses 'virtual teachers' from universities in Spain and globally.

6. More recently the governments in Finland and Norway have launched similar initiatives, again with substantial capital and support from both state and industry. Each also has global aspirations. Recently the best selling MBA in Singapore was from Finland because of its innovative approach to e-learning.

7. NextEd is an education and training infrastructure company which partners with universities and others to deliver courses over the internet to the Asian market. It has e-learning technology platforms in six countries and provides education institutions with a technology infrastructure to support the delivery of accredited higher education content and professional training to adult learners. It also has agreements with universities in several countries outside Asia.

8. Fathom is an e-learning portal which makes consolidated provision from multiple sources by aggregating, hosting and distributing content. Working with its partners, which include the London School of Economics, Cambridge University Press and the British Library, it provides e-learning opportunities on a range of subjects for a diverse lifelong learner population. Tools and resources are overseen by an advisory board drawn from its partners. It also offers customers an immediate way to purchase books, journals, periodicals, and articles that are directly related to the subjects in which they are most interested.

9. On the corporate training front, Global Learning System is a web-based corporate training company which recently merged with the European Training Group (ETG) based in the Netherlands. ETG has 60 training locations in 15 countries providing multi-language modules in various formats to large global corporations using the internet and various new media, including video, CD-ROM, connected DVD, satellite and related access systems.

10. Pearson plc is an international media company based in the UK, that has undertaken a series of strategic alliances to invest in on-line education and extend its reach. Pearson Education is one of the largest providers of curriculum materials in print, electronic and on-line formats (in both school and higher education). It has plans to offer a full range of accredited courses in the US in partnership with a number of top business schools and professional bodies.

11. Pearson's on-line Learning Network is an initiative that consists of four integrated networks to serve four distinct learner markets, with revenues intended to be generated by subscriptions, sponsorship, advertising and product sales. The four networks will share common technology, infrastructure and marketing, and be supported by an on-line store, which will host e-commerce opportunities. It has separate networks for higher education, for professional development (focused on English language, IT and business) and for lifelong learning – as well as a fourth for schools.

12. Not surprisingly perhaps, the widest range of developments has been in the US where the 'value chain' in higher education is increasingly becoming disaggregated. This is opening the door for a whole range of new entrants to provide separate components of e-learning, and niche vendors are emerging in a variety of areas. The result is transforming the industry and altering the historical role of universities, both by creating opportunities for partnerships and by producing additional competitive threats. Examples of disaggregation already operating include 'infomediaries' to inform the college selection process, on-line admission and

applications, e-learning portals, supplemental content providers, on-line libraries, separated advising and tutoring, external assessment services, student activity/portal sites, on-line textbook distributors, e-learning platform companies, and campus-based portals.

13. Many colleges and universities in the US – and elsewhere – have already formed innovative partnerships with for-profit vendors in order to capitalise on the market opportunities which arise from the rapidly growing demand, but for which significant resources are needed to develop content. Some of these for-profit companies enable universities and colleges to produce and distribute courses.

Annex 2

Options for the corporate structure of the e-U

Requirements

1. In designing the corporate structure, there are a number of requirements to meet the objectives as developed in our report. These include:

a. A structure that will create a sense of ownership of the e-U in UK HEIs, and that will secure their support and input. It must capitalise and build on the expertise and reputation for high quality learning that already exists, and use this to secure existing and new markets.

b. A structure which provides the drive and flexibility to operate in this fast moving and rapidly developing market. The concept and need for the e-U have been driven by the recognition that new technology provides exciting new possibilities for delivering learning in new ways and to new markets. The potential of the e-learning market is galvanising existing competitors into action as well as attracting new names into the market daily. The e-U will be in competition with these highly commercial and focused operators. The UK brand will be an advantage, but it will need to be coupled with a dynamic, market orientated and fast moving organisation if it is going to succeed.

c. A structure which is attractive to the private sector both as an investor and a partner. The e-U will need private sector investment and private sector commercial expertise to make it work. If it is to attract the right partners, they will want to be part of a commercially minded organisation and have access to a share of the profits. In return, and in addition to their investment, the e-U needs to have access to their marketing, contracting and other expertise.

d. A means of harnessing a powerful combination of brands which will provide the e-U with credibility and access to key resources and services. Advice from specialist branding consultants suggests that the e-U will need to develop its own brand, but this process will be helped through tying in recognised quality brands to support the UK HE name.

e. A structure which provides flexible arrangements to secure partnerships with a range of whichever companies or organisations can provide the best services to support the activities of the e-U.

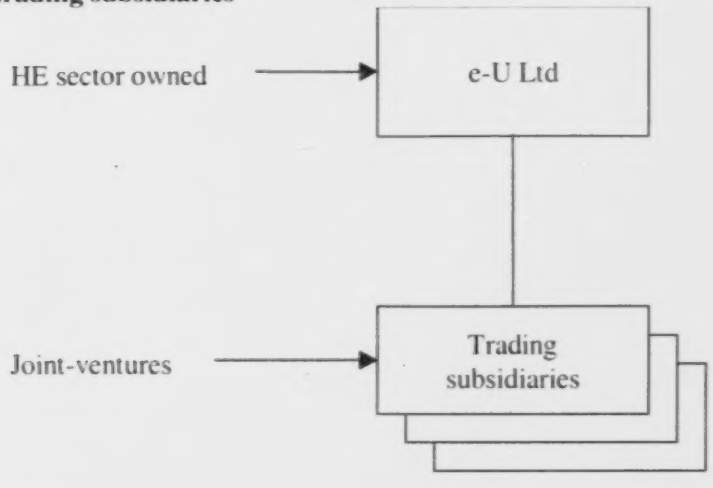
2. There are two givens which we assume will apply to any structure:

a. In appointing the chief executive and senior management team of the e-U, a key consideration will be to secure the drive, dynamism and experience necessary to develop the e-U. It is not the corporate structure alone that will provide the channel for securing private sector drive and expertise: this will also come from the management team. The team should have experience of the HE sector and the private sector and would have responsibility for devising the strategy and securing its delivery.

b. Whatever roles private sector organisations may play in the e-U corporate structure, contracts for delivering out-sourced e-U services would be awarded to the best provider, with no preferential rights for particular companies.

3. There are a number of possible structures, but our work has focused on four main options.

Option 1: e-U Ltd to be wholly owned by HE sector operating through a number of trading subsidiaries



Key features

4. The e-U Ltd would be wholly owned by the HE sector. It could be a company limited by guarantee with each HEI being a member. Alternatively, it could be a company with a share capital, with HEIs holding the shares. This might provide a more concrete expression of ownership by the HE sector, and a structure with greater flexibility for the future, for example in raising investment or even selling all or part of the company. Charitable status might be sought for one or more subsidiary companies through which the charitable activities of the e-U could be channelled.

5. The e-U Ltd would be set up as a self-standing organisation with a board of directors, management team and core staff. It would have responsibility for setting the strategic direction of the e-U, for operating and overseeing the quality gateway, and for brokering the partnerships to deliver the e-U products.

6. Trading subsidiaries would be set up to deliver the e-U in specific geographical areas, specific subjects and for specific services. These would be joint ventures with the most appropriate partners, with such partners investing in equity in return for profit share. The e-U Ltd's share of these profits would be covenanted to it and used for further development. The trading subsidiaries could become substantial companies in their own right, offering a means for private sector partners to share in a clearly identified part of the e-U operation.

7. The main advantages of this structure include:

a. It may be attractive to the HEIs because it keeps ownership and control very clearly within the sector, thus ensuring that they are the guardians of quality and the use of the e-U name.

b. It would retain the independence of e-U Ltd and help in positioning it as an impartial and top quality provider. It would also allow it greater freedom to enter into partnerships with a variety of partners and providers at the trading level.

c. It would avoid the suspicion that private sector partners would be able to secure preferential positioning in tendering for particular services or parts of the e-U operation by virtue of their involvement at the top level.

d. Those HE sector bodies empowered to appoint the directors of the e-U company could choose to appoint individuals with private sector experience and expertise.

8. The drawbacks of this model include:

a. If it were set up as a company limited by guarantee, e-U Ltd would be less flexible for the future and, at this level, it would not be as attractive as an investment vehicle for external investors.

b. If ownership was restricted to the HE sector, investors would have to be involved at the subsidiary company level. Some potential partners and investors may be reluctant to be involved if overall strategy and direction were to be decided at the higher level from which they were excluded, and decided solely by representatives of the HE sector. This would cut off a major source of funding.

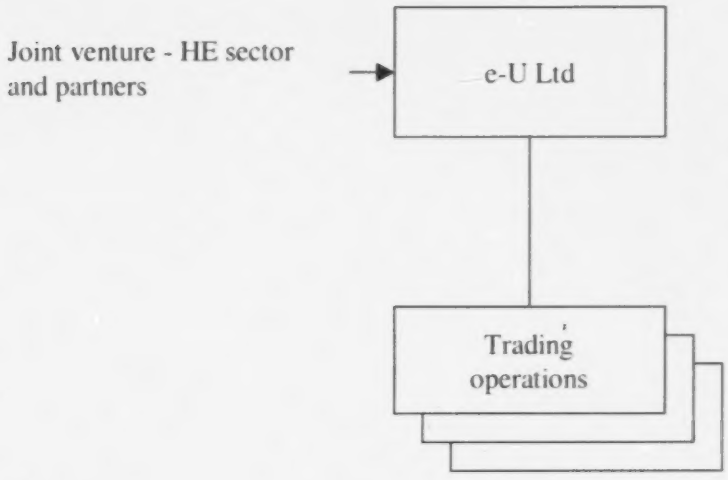
c. The e-U Ltd would not receive the potential benefit from the infusion at the top level of the drive and experience which private sector partners could bring in developing its strategy.

d. As a consequence of b and c, the opportunities for securing a significant private sector investment up front and at the top level would be foregone.

e. Whilst performance-related remuneration packages could be devised, it could be difficult to attract e-business expertise into what would be a 'not-for-profit' organisation.

f. Whilst the organisation would be developing relationships with the partner organisations at the operating level, it would be more difficult to build on these relationships and use their potential brand advantage from day one, compared with the opportunities available if the partners were involved at the higher level. The top level brand would be solely HE-derived, not HE-plus-others.

Option 2: e-U Ltd set up as a joint venture company with a small number of core partners.



Key features

9. The e-U Ltd would be owned jointly by the HE sector and a small number of partners. The HE sector could hold an absolute or relative majority. Partners would contribute to up-front investment and share in the risk and rewards of the operation.

10. The e-U would have its own brand and build on the brands of the UK HE sector plus the core (non-HE) partners.

11. The e-U Ltd might operate either directly through operating divisions or through a network of other subsidiaries which might be joint ventures with other organisations (as in option 1).

12. The advantages of this model include:

a. As a company capable of making and distributing profits it would be attractive to external investors and relatively straightforward in terms of securing working arrangements with two or three key partners.

b. It offers possibilities of securing upfront investment in the overall concept.

c. It may have advantages in terms of setting up a brand and embedding two or three key brands alongside the UK HE sector. This may give a more powerful marketing message from the start of operations on which to build the e-U's own brand identity.

d. It would tie-in private sector commercial awareness and drive at the heart of the organisation and in determining its strategic development. It may also be more attractive to potential e-business staff to work for what might be seen to be a more private sector and commercially focused business.

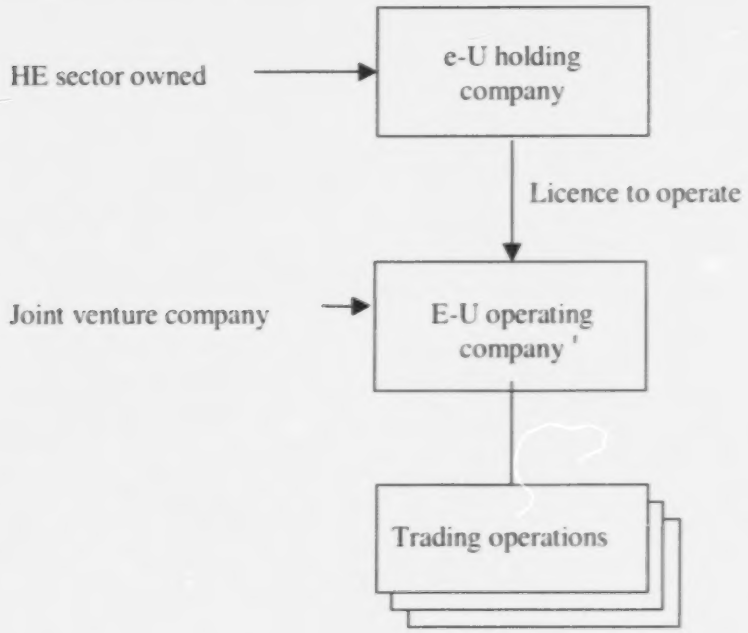
13. The drawbacks include:

a. It would be vital to find the right partners who were acceptable to the HE sector. There could be a risk of tying the e-U brand, and all that this entails in terms of UK HE quality, to organisations who could damage that reputation through their other activities.

b. There might be conflicts of interest which would have to be managed. The most obvious of these would be balancing the drive for commercial returns with quality of delivery. Of course this is not a new issue – HEIs themselves have to address this in their own operations. But it would be a major issue in this new area of learning delivery. It would be harder (although not impossible) within a single joint venture company to safeguard on a permanent basis the e-U's academic integrity and purpose.

c. A second potential conflict would be in ensuring that the e-U was able to secure relationships and contracts with the best suppliers in its different areas of business rather than being tied to using the partners' own organisations. This freedom would be important in supporting the reputation for high quality.

Option 3: HE sector owned holding company retaining the licence to the e-U brand, with the licence granted to a second company (e-U operating company) in which the holding company would hold equity along with a small number of partners



Key features

14. Under this option the HE sector would retain absolute ownership of the e-U brand through the e-U holding company and would license the 'e-U operating company' to manage and operate the e-U on its behalf. The operating company could be a joint venture with a small number of partners with equity investments.

15. The operating company would be responsible for all aspects of the operation and delivery of the e-U within the terms of the licence. As with option 2, it could operate either directly or via a number of subsidiaries which could, in turn, be joint ventures with other partners.

16. The holding company would be the vehicle for securing HE sector ownership and would have a board of directors. They in turn would appoint members to the board of the operating company alongside the partner organisations, but this would be the extent of the holding company's involvement. The holding company could be a company limited by guarantee or it could be a company limited by shares. Either way it would have a passive, rather than an active, role in owning the brand and protecting its integrity. The profits of the operating company attributable to the HE sector would return to the holding company.

17. The advantages of this model include:

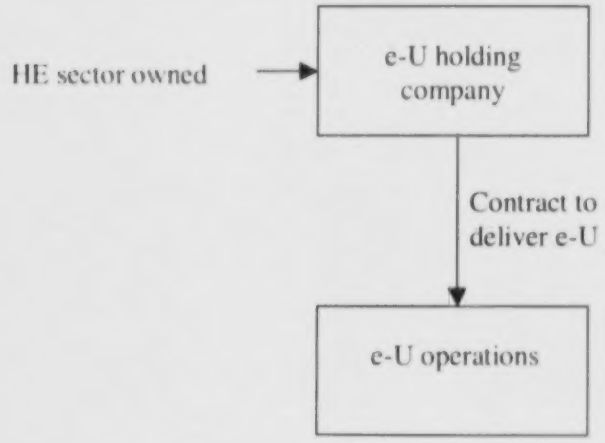
a. The HE sector owns and controls the brand through the licence. The holding company's role in the operations of the e-U would be through its right to appoint a number of directors to the operating company and through the terms agreed in issuing the licence.

b. The model has the advantages of option 2 in terms of attractiveness to other partners and in securing their investment and management expertise. It differs from option 1 in that matters relating to the top level strategy of delivery and operation would rest with the operating company.

18. The drawbacks of the model include those in option 2 concerned with securing the right partners and managing potential conflicts of interest.

19. The attractiveness of the operating company to private sector partners will depend to a large extent on the powers reserved to the holding company through the terms attached to the licence. Put simply, the greater the freedom given to the operating company, the more attractive it would be to external partners. On the other hand, the right partners would recognise the value to the success of the e-U enterprise of developing and maintaining a reputation for academic excellence, and that the holding company model could promote that reputation by demonstrating that the core academic purpose would be permanently safeguarded.

Option 4: HE sector owned holding company contracting with one or more partners to operate e-U on its behalf



Key features

20. The HE sector would own the e-U company and the name but contract out the management and delivery of the e-U to one or more organisations.

21. In many ways this would be similar to option 3 but the relationship would be by way of a contract rather than a joint venture.

22. The contracting company/ies may invest in order to secure the contract and in return for performance-related payments.

23. The advantages of this model include:

a. It would be attractive to the HE sector in retaining ownership within the sector (as options 1 and 3).

b. It would provide a means of securing private sector involvement and expertise in running the organisation (as options 2 and 3).

c. It could be a means of securing external investment in all levels of the organisation (as options 2 and 3).

d. An operating contract could be more attractive to some private sector organisations in offering greater specificity and certainty about the level of performance required.

24. The drawbacks include:

a. The contract would be very difficult to draw up in a fast moving and relatively unknown market. In the early years, there is bound to be a real issue of feeling the way and trying to provide the flexibility for the e-U to establish itself. Providing this flexibility whilst at the same time having good performance targets built in would be very difficult to achieve.

b. Whilst it would secure private sector involvement in the delivery of the e-U and it could be used to secure investment in return for the contract, it would not create the same degree of partnership and shared goals as would an equity sharing relationship within a jointly owned company. The efforts of the private sector operator would focus on delivering the contract rather than on the wider question of strategic building of the enterprise.

c. There are parts of the operation which could not be contracted to a private sector organisation – notably, the setting and safeguarding of academic quality and standards. So the concept of bundling the whole enterprise into a single contract would be difficult to secure, since there would have to be reserved activities remaining under the direct control and operation of HEIs.

Conclusions and recommendation

25. The preferred solution needs to provide the right balance between HE sector inclusion and private sector investment and involvement, as well as being able to put together a powerful collection of brands from which to launch the e-U. It is also important that the e-U

has the ability to set-up and launch as rapidly as possible, given the need to secure market presence and the lead time in developing new content and the technology platform.

26. Option 1 would have the attraction of setting up the e-U as an 'independent' organisation with strategy and direction controlled by the higher level company, and delivery through a series of joint ventures. The downsides of this model are that it would not allow private sector investment at the top level, and investment at the delivery level may not be as attractive. The other potential downside is that the top level organisation may not maximise the commercial and market focus and the drive which could be achieved through a closer relationship with private sector partners.

27. Option 2 would bring a much stronger commercial focus to the e-U. The downside is that it may not be 'inclusive' enough for the HE sector in the structure. HEIs would be a partner alongside a number of other players. On a more practical level, it would not provide a ready vehicle for the HE ownership. It would not be practical for each HEI to have a direct share in the joint venture company. Their ownership would have to be expressed collectively through the sector bodies.

28. Option 4 would provide the sector with clear ownership and would bring in commercial partners to deliver the operations though the contractual relationship. The weakness in this model would be the dependence on the contract for this delivery. The nature of the business would make the design of a contract very difficult indeed.

29. Option 3 would seem to achieve the right balance on the key issues:

a. It would secure HE ownership of the brand and the name. The holding company would also provide a corporate vehicle for the HE sector and it could be a company limited by guarantee or by shares.

b. Operations would be delivered through the operating company which would be the market face of the e-U and which would operate and deliver the e-U. The HE owned holding company could hold a majority of shares in the operating company and the right to appoint a number of directors. Equity stakes could be taken by key partners, again giving them the right to appoint a number of the directors.

c. The operating company could set up a series of subsidiaries with specific market, subject or service focuses through a further range of partnerships.

d. It would provide a means of getting the operation up and running rapidly using resources from the partner organisations.

Annex 3

Learning products and services for the e-U

Contents

1 **Introduction**
The use of technology in teaching
Basic model for the e-U

2 **Learning materials and the learning environment**
Benchmarks for on-line learning
The effectiveness of on-line learning
A framework for tools and services

3 **Production of learning materials**
Production framework
Production methods
Emerging international standards
Innovation in developing learning materials

4 **Commissioning of courseware**
Content asset management facilities
Ownership of course materials

5 **Supporting on-line learning**
Learning support services
Learning assessment and awards
Library services
Learning programme management

1 Introduction

1. In this annex, we examine issues relating to the delivery of a high quality learning experience on-line, including a consideration of the basic components of a framework for the development of learning materials. Just as teaching in a traditional university environment draws upon material from a range of sources, so the same will be necessary for programmes developed for delivery on-line. Other services will also be required to support the learner and the tutor both as part of a conventional learning environment and as part of a distance learning provision. We also propose the development of new quality assurance methods for material production more suited to meeting the circumstances of a technology-based approach.

2. This annex is not intended to be a detailed prescription for the operations of the e-U, since those will need to be developed by the e-U itself. Our purpose is to suggest the elements of the approach that the e-U might consider, which, if accepted, the e-U would then develop into its own design.

The use of technology in teaching

3. As computer technology continues to develop, it is evident that the underlying power and speed of computation combines with the power of software applications to provide creative interfaces to enhance the computer as a tool in teaching. The use of simulations, to take one example, to illustrate complex physical or economic situations can be used to considerable advantage in teaching and learning, providing opportunities for deeper understanding and insight into the subject. Such applications increase the effectiveness of technology used as a tool in teaching and learning. This can only improve further as the underlying technology develops in the coming years.

4. The other technology that, in a very short period of time, has had a profound effect on the way we access information, is the internet. The growth of access to the internet is unparalleled and has had the effect of reducing or eliminating the effect of distance. Communication technology is the additional underpinning element facilitating the move to e-learning.

5. These forms of technology are different but complementary. The use of computers as a teaching tool is creating a new paradigm for teaching methods – even when only used as an adjunct. The development of the internet and the World Wide Web has provided access and the ability to communicate with large numbers of people all over the globe. The two taken together are fundamental ingredients for distance learning. They are each necessary but not yet sufficient for its effective delivery. The current version of the internet and connections to it are not entirely satisfactory for the general user who has to make use of a relatively slow dial-up connection. The advent of the next version of the internet promises far greater bandwidth in communications, making it possible, for example, to deliver high speed video to the home. The combination of very high speed communication links and the further enhancement of the power of networked computers provides the potential for further innovation and creativity in designing many new applications, including those for teaching and learning.

6. On this basis, current distance learning applications contain only a fraction of the functionality that will be possible with the next generations of technology. No one has yet fully explored even the current potential, which gives an opportunity for the e-U to lead the field. We should not be too hasty in making judgements about the use of today's technology, as the rate of change is such that what was unknown five years ago can today be taken as a way of life. More importantly, the existence of a capability now, however rudimentary and incomplete, can stimulate creativity in its use, and form the first step along the path to a vision.

7. Another important development is the formation of the Technology Integration Centre (TIC). The TIC is funded by the Joint Information Systems Committee (JISC) of the UK higher education funding bodies. Its focus is on the identification, proving and development of new technologies which could be applied to learning and teaching. The TIC could therefore help with the development of the technology used by the e-U both in the creation of learning materials and in the delivery of programmes to learners.

8. The effectiveness of technology in teaching has still to be demonstrated convincingly but research is already pointing to new paradigms in teaching methods. What is not fully known at present is how best to use the technology in the light of the complexities associated with the processes of education. There are many pressing and challenging issues to be addressed, for instance, the extent to which it is possible to deliver a quality educational process wholly on-line with only on-line intervention of a tutor. The use of the technology can be the tool to explore the underlying processes that, in the end, effect the transfer of knowledge and development of understanding. Our concern is to look forward to the next generation of technology whilst considering how best to use it in the provision of e-learning.

9. Equally important is to recognise that there are different groups who might benefit from learning on-line. At least initially, the expectation is that the needs of those groups seeking continuous professional development and lifelong learning will be met most effectively by e-based provision. More traditional undergraduate needs may be a little further behind. Different levels of maturity, levels of experience, different job functions and so on all require different forms of learning experience tailored to specific requirements. In comparison, the world of education delivery has changed far less than the commercial world of high technology production and services. Major opportunities for educators, identified in many studies – including the HEFCE/CVCP report on 'The Business of Borderless Education' – arise from these different requirements for access to education by different classes of learner with solutions that, in some cases, will require the use of new and evolving technology.

The basic model for the e-University

10. Our report outlines the recommended models for structuring the e-U. Within the following discussion of courseware production and of the various tools and services required by the e-U, there are several ways in which the e-U could operate. At one end of the spectrum – not proposed in the main report – the e-U could operate as a fairly conventional and complete but 'virtual' university, with software systems to provide effective learning and support environments for both learners and tutors. It could also provide a raft of other services to support the management of learning, the administration of programmes, learners and tutors, quality management, financial control and records of learning and other functions associated with the delivery of an on-line service. To create an entity working in this way,

the e-U would need to put in place all the infrastructure and platforms to support the on-line services mentioned.

11. At the other end of the spectrum, the e-U could function exclusively as a provider of tools and services for use by other universities. This is a component of the model proposed in our report. As a service provider, it could license its tools and services to say, University A. University A would then use them to develop its own distance learning programmes, serving its own markets and carry its own 'branding' on the programmes. The advantage to University A is that it would not have to find the capital cost of establishing and maintaining the expensive tools and services that form the essential underpinning.

12. Many of the tools and services could be maintained centrally and delivered and used in geographically dispersed locations with suitably fast internet connections. From a technology standpoint, this type of provision of tools and services would form an Application Service Provider (ASP) function. Other services, such as those associated with instructional design, quality management of programmes and so on could be provided by the e-U working with members of University A, either centrally or on the same site.

13. There are many points in between these two extremes. Our report proposes that the e-U should start towards the middle of the spectrum. It would not make its own provision but would provide a facility for others, with suitable quality control, to make provision using the e-U's expertise, brand and marketing – perhaps jointly with their own. The e-U would also be proactive in developing provision, but it may, under agreement, also act as an ASP for some types of provision.

14. Even within this construct, there are alternative models depending on how the content of learning programmes is provided and by whom. University A could for instance use (and pay for the use of) the e-U tools and services to construct a learning programme for its own postgraduate degree. Alternatively the e-U might agree that University A would provide the subject expertise from amongst its academic staff to assist in the construction of a postgraduate learning programme under e-U auspices. The e-U would then market and sell the programme to learners both overseas and in the UK. If University A wished to market the same learning programme, this would only be possible under a pre-arranged agreement.

15. There are, of course, important issues associated with the ownership and copyright of the material, many of which will be affected by the policy of individual institutions. These will have to be addressed up front to avoid them becoming contentious. Ownership of on-line courseware materials has occupied the minds of many in the US, and the matter has been considered in some detail in a recent report on the subject ('Who owns on-line courses and course materials? – Intellectual property policies for a new learning environment' Carol Twigg, Centre For Academic Transformation at the Rensselaer Polytechnic Institute, 2000). We cover this point in more detail later in this annex.

16. By working with the e-U in this way, each UK HEI would be able to add distance learning provision to its own distinctive portfolio without the need for a large capital investment or a significant budget to maintain services and standards. An HEI may also wish to offer distance learning programmes that combine modules created by its own staff with those created elsewhere (with or without the e-U's delivery mechanism). To facilitate this, the e-U would have a repository of learning material produced and marketed under its own auspices, which would be available to any HEI wishing to purchase a licence for its use. A

repository of learning material is in principle an attractive proposition because it would lead to the re-use of materials and an eventual cost saving in the development of new learning programmes. Reusable modules of learning are common within many traditional higher education programmes, but there would need to be ways of ensuring coherence of modules of computer-based material.

17. The above has been expressed from the perspective of the supply side. As our report makes clear, the important flexibility offered by the e-U is to the demand side, as consumers of e-U based materials would be able to package modules from different sources on their own – with the assistance and advice of a navigator service. Coherence would then be the responsibility of the awarding body (and/or the navigator).

18. This annex identifies the issues that are important in the development of learning materials and the support services for the e-U and which will need to be developed in greater detail for the operation of the e-U venture. The two most fundamental components of the infrastructure are the ability to design effective learning programmes and the ability to provide effective support for both the learner and the tutor. The first of these issues is addressed in sections 2, 3 and 4; the second in section 5.

19. We summarise our starting point as follows:

a. The e-U would provide opportunities, assisted as necessary by the use of its tools and services, for HEIs to contribute modules and courses to learning options marketed by the e-U, subject to quality conditions.

b. The e-U tools and services might also be made available, under an ASP approach, to those HEIs wishing to develop their own e-learning capacity (and/or to convert their existing courseware materials). The provision of such expensive infrastructure would benefit the sector and could be a key commercial offering from the e-U – although the e-U would need to take care not to undermine provision made under its own auspices.

20. The anticipated spread of high bandwidth internet capacity to the workplace and home, and the development of hand-held and other devices connected to it, require learning content that can be provided through different delivery channels and devices. The e-U tools and services would need to anticipate these developments in the provision of an e-learning Content Asset Management arrangement.

2 Learning materials and the learning environment

Benchmarks for on-line learning

21. The growth of access to the internet has been led by users in the US. The number of US universities and colleges now offering distance learning education has grown strongly in recent years. The number of distance programmes increased by 72 per cent from 1994-95 to 1997-98, with over 1.6 million students enrolled in distance education programmes. Accompanying this enthusiasm for on-line education has been some scepticism, reflected in a number of studies into the effectiveness and quality of on-line education.

22. To help the debate, a study of several US institutions with considerable experience of offering distance learning programmes set out 24 benchmarks for success in internet-based distance education. Whilst these are not a definitive set, they list the issues that should be taken into account under seven headings – albeit within a fairly traditional 'virtual university' setting. We would refer HEIs wishing to make distance learning provision to the full list ('Quality on the line – benchmarks for success in internet-based distance education', April 2000, the Institute For Higher Education Policy). The headings suggested are: institutional support, course development, teaching/learning, course structure, student support, faculty support, evaluation and assessment.

The effectiveness of on-line learning

23. There has been considerable debate about the effectiveness of on-line learning in comparison with traditional learning – see for example the much quoted report by Phipps and Merisotis entitled 'What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education' published by the US Institute For Higher Education Policy. This carried out a detailed study of the methods of research used to investigate the advantages and disadvantages of on-line education.

24. The main arguments levelled against the use of on-line learning reflect concerns that there might be a lack of interaction between student and tutor, based on physical presence, and the difficulty of forming a community of learners. Work on learning styles points to the variations in the way people learn and surveys reveal that, at least at undergraduate level, students learn better by active participation rather than by passively listening in large lecture classes. However, other work suggests that insufficient attention has so far been paid to the potential uses of the new technology. Those actively engaged in the exploration of technology in teaching outline a new paradigm for teaching, and stress the importance of the need to avoid simply trying to replicate the old way of doing things using the new technological base.

25. While the role of the tutor as mentor and instructor is important, on-line interaction with tutors is now being incorporated into commercial courseware provision, and collaboration tools are being used to create communities of learners. Innovation in the use of such tools will follow as the functionality and capabilities of the technologies are explored and investigated. From work carried out using these tools, it is apparent that a combination of sound instructional design applied to the development of the learning materials, coupled with some mediated collaboration on-line, can provide an effective learning experience for the learner.

26. A prime imperative for the e-U is to recognise that there are different categories of people who would benefit from on-line learning. Young undergraduates have learning requirements that are quite different from those of highly motivated mature learners in the professional workplace. An understanding of the relevance of learning requirements and styles must precede the design and implementation of learning programmes. The learning environment and the facilities available to support the learner, both on-line and off, should reflect the elements of sound pedagogy relevant to the groups concerned. It is the design of these facilities that will be so important to the success of the e-U concept.

27. The e-U must approach this task in an open and forward looking way and be willing to explore new paradigms of teaching and learning that make full use of the technology. It

should not attempt to replicate the lecture on-line and it should not limit its consideration to the technology available today. Projecting the likely technological scene three years hence carries a risk, but there are sufficient indications in some areas, for example in communications technology, to give good confidence about bandwidth realisation etc. What is less easy to foresee is the use that will be made of the innovative technology and how this will fundamentally change the approaches to teaching and learning.

28. On top of all this, market pressures are also likely to change attitudes fundamentally and will certainly create opportunities for new developments in e-learning – we have already noted the huge interest in the use of the internet to deliver training in the commercial sector. The number of companies now offering on-line courses has increased markedly even in the past six months. Others have developed innovative products incorporating fairly full on-line support for the learner. The challenge facing the e-U is to capture innovation in the design of tools and services in order to support innovative design of courseware and interactive learning environments and so guarantee a quality learning experience.

29. The e-U might seek to contribute to thinking on the development of on-line educational provision, not least by means of studies which systematically investigate comparisons of effectiveness between traditional and technology-based methods of learning. Such work would assist the e-U to develop learning environments which provided new ways for learners to organise their studies more effectively within the construction of programmes.

30. There would need to be a way of evaluating the effectiveness of any learning programme across a range of learners and over a period of time. Such evaluations would help build an understanding of the pedagogical effectiveness of programmes – although little systematic evaluation of this form has been reported in the literature. Perhaps even more important is the need to be able to evaluate the complete learning experience of the learner, covering all the modules studied and the services received. Such evaluation for any programme leading to an award would normally be undertaken by the awarding body but with the results of the evaluation passed back to the e-U for its own evaluation purposes. In addition to acting as a gateway for proposed material, the e-U's committee for academic quality, described in our report, would also keep modules under review to ensure they were up-to-date and would seek re-provision when needed.

A framework for tools and services

31. To ensure its success the e-U should play a central role in establishing a framework within which high quality courseware materials can be designed and thus from which effective learning programmes can be created. It should also be responsible for ensuring there is an effective learning environment available to support the learner. The supporting services within the framework should form an integral part of the whole that distinguishes the nature of the 'brand' of the e-U provision.

32. A fundamental objective of the e-U is that it should deliver excellence in the context of 'fitness for purpose'. It must therefore recognise that different categories of learners will have different requirements both for materials and for various levels and types of support. This will mean that the levels of support may well range from none over and above that built into the courseware materials, to full on-line support provided by a tutor. In some cases, especially where there is a certified programme of learning, the body making the award may

wish to specify the type and level of support which learners should use. In other cases it will be the learners who decide on the support they want.

33. Different categories of on-line learners will have different learning requirements and these will need to be reflected in the construction of the learning programmes they use. Just as traditional learning materials for a single course are drawn from different sources, so on-line courseware will be composed of material drawn from different sources. In the traditional case, the integration and creative interpretation of the material is carried out by the tutor, who then guides and encourages the student through complex sets of interactions, formal and informal. By their very nature, learning and understanding involve more than a single mode of 'delivery': computer-based learning will only be a part of the total learning experience of e-U students, with the other parts arranged by themselves, their employer or other third parties.

34. Our report proposes a design for the e-U in which:

a. The e-U would not be a traditional university implemented virtually, but rather the vehicle for delivering new high quality learning experiences matched to the needs of the individual and the demands of the market. It will provide a wide variety of learning modules and programmes and choices of delivery channels and support services, matched to market demands.

b. The e-U would be able to provide for differing balances between richness and reach. Traditional distance learning has achieved good reach whereas conventional campus-based education can achieve high levels of richness. The e-U will be able to provide varying balances of richness and reach on demand, with the appropriate combinations of learning and support. In this way the reach of traditional distance education can be combined with a richness not hitherto available to distance learners.

3 Production of learning materials

35. The framework for the production of learning materials should allow for several modes of operation of the e-U concept as set out in section 1 of this annex, but always with the highest quality and effectiveness assured and maintained over time. We can envisage several different ways, each of which the e-U should operate, to assist with the production of courseware materials:

a. Draw upon, by commission, the subject expertise of academics (and others) to design courseware materials for specific market opportunities under the e-U auspices. For any one programme the expertise might be drawn from one or several institutions, companies or other organisations.

b. Provide repositories of e-U quality-controlled learning materials.

c. Provide teams expert in instructional design and the construction of learning materials, and provide other tools and services (under contract) to any HEI wishing to construct on-line learning provision for its own purposes.

d. Be a 'facilitator' to allow any HEI to offer its own on-line material under the e-U brand (subject to quality control), supported by the services of the e-U.

36. The framework for the production of learning materials should be sufficiently flexible to allow for each of these different modes of operation.

Production framework

37. Some HEIs already have facilities for the design of high quality courseware materials and, in principle, could become suppliers of a service to the e-U. However, most current courseware design methods rely on proprietary authoring tools that do not support interoperability, so materials obtained from several sources cannot easily be integrated. A framework to provide interoperability of e-U based materials would be a requirement to achieve flexibility in learning programmes. While most authoring tools produce material that can be run in a standard 'browser', developments within the international standards bodies will increasingly expect the use of 'metadata' to describe the content in ways that allow it to be described and searched. In future the construction of electronic documents of all types will increasingly be XML-based (Extensible Mark-up Language) to allow a separation of structure, content and format.

38. Within some HEIs, the 'production process' tends to rely on the enthusiasm of a few members of the academic staff – which does not always produce an effective operational process and can result in insufficient involvement of the 'subject experts'. It is neither desirable nor appropriate for large numbers of academic staff to become expert in the use of courseware authoring tools. In any case, the design of effective courseware materials involves much more than the use of an authoring tool. In the development of materials, it is more appropriate that subject experts should be creative and work with and advise experts in instructional design, in graphical design, in the production of audio and video materials and in a range of other services to ensure the high quality needed to meet the standards which will be specified by the e-U. Many such services are available from specialist suppliers, who could operate within a framework of specifications defined by the e-U. Such a framework must not constrain creativity in the design of interactive learning experiences. The scaleable production processes should be based on tools and services that provide the infrastructure to facilitate the design and delivery of high quality, effective and assessable learning experiences within a well defined and supportive learning environment.

39. In seeking subject expertise for the content of learning modules and programmes, the e-U may need to use a brokering activity. Such a service could be provided through the Subject Centres of the UK-wide Learning and Teaching Support Network (LTSN), which is supported by the UK higher education funding bodies. The LTSN has associated with it 24 Subject Centres and the Generic Learning and Teaching Centre (GLTC). The principal functions of the LTSN with respect to learning, teaching and assessment are the creation and facilitation of networks, the promotion and transfer of good practices, and the brokering of knowledge, information and expertise. The Subject Centres may thus develop a view on best practice of the use of technology in teaching. Sharing best practice in both directions could benefit both the e-U and the sector.

Production methods

40. The overall design of learning materials for provision by the e-U would be the responsibility of a team including one or more subject experts. The processes would be driven by pedagogy based on sound instructional design principles and would use technology where appropriate to create an effective learning experience. The team could work with the technology-based tools and services provided as part of the e-U infrastructure, but would have the flexibility to use the most appropriate authoring tools for the task as long as they resulted in interoperable materials.

41. We would suggest that the actual production of courseware materials might also be guided by a process framework containing, at least, an agreed set of guidelines. The guidelines could take the form of a set of steps for each stage in the process, starting with the specification of requirements through to the implementation of the material in the learning environment.

42. The guidelines might cover the following points:

a. Development of the requirements for the design of courseware materials for delivery partly or wholly on-line.

b. Functional and technical specifications for the courseware materials.

c. Instructional design practice which matches the learning experience to the required learning objectives.

d. Inclusion of appropriate forms of formative assessment to assess the progress of the learner.

e. Inclusion of appropriate forms of summative assessment to assess the achievement of the actual learning outcomes against the learning objectives.

f. Exercises to explore the learners' ability to integrate and use knowledge.

g. Structuring of the courseware into 'modules' etc within an agreed curricular taxonomy.

h. Ways of ensuring effective inputs from subject experts on the conceptualisation and exposition of knowledge.

i. Use of 'best practice' in innovation in the use of technology to achieve novel and effective learning experiences.

j. Where appropriate, ways of integrating modules to form coherent learning programmes that would meet specified learning objectives.

k. Quality assurance procedures to test the technical precision of the design against the requirements specification.

l. Quality assurance procedures for the operational accuracy of the product against the functional and technical specifications.

m. Quality assurance procedures relating to the pedagogical effectiveness of the product.

n. Compliance criteria to ensure the courseware material is acceptable in relation to the emerging international standards for interoperability across delivery platforms and for re-use.

43. A published reference guide might be produced by the e-U, but we suggest that it might also consider ways of driving the production processes using a set of templates, especially for those courseware materials that were assembled using 'learning objects' from different sources. The purpose of a template would be to assist in the collection of the required information and relevant parameters in a structured and efficient manner. Structuring the design processes in this way would ensure that all the relevant information was available to those who would carry out the creative design but without constraining their creativity. Templates could be produced for each stage in the overall process, and could be computer-based and semi-automated to help the design teams structure the workflow processing.

44. There are several advantages of using template-driven processes. Where production was taking place in several centres, a greater degree of uniformity and consistent high quality could be achieved, as the templates would drive the team interfaces and would include the parameters relating to the various measures of quality. Quality assurance would then become quality management for each of the individual steps. Each stage of the design process could not be signed off until the specific quality measures associated with it had been supplied and accepted. Quality measures would thus be designed into all stages of the process and so would be fundamental to the whole operational framework.

45. On this approach, the e-U would define the steps of the production process and might also suggest which services could be provided by external specialist providers. To illustrate the point, the suggested production process might include the following:

a. Determine the level of demand for a particular learning programme by reference to the market surveys or potential customers/clients (which might have been done by the e-U itself).

b. Assemble the internal design team to be responsible for the development of the material, including subject experts on the content.

c. Produce an outline plan of the courseware materials in terms of the learning objectives and required learning outcomes. Sign off description of the intended material with the customer/client (which would often be the e-U itself).

d. Conceptualise, capture and illustrate the subject knowledge required to meet the learning objectives.

e. Structure and design the learning experience to be provided by the courseware materials in terms of the size of modules (if more than one) and the coherence of the programme (if a full course).

f. For each module, decide the functional specification in terms of the interactivity with the learner, the level and ways of building tutorial support into the material itself and the links with other materials.

g. Decide the appropriate formative assessment exercises and the ways of providing feedback to the learner (and to the tutor if appropriate).

h. Decide the summative assessment associated with each module and the criteria for the levels of learner achievement.

i. Establish a range for the possible levels of on-line tutor support for each module.

j. Consider the interface between the learning programme and its sub-parts and the administrative support software tools.

k. Review, perhaps with additional external peer subject experts, the evolving design in terms of subject accuracy and coherence of the modules within the overall learning experience.

l. Complete the detailed specification of each module (if more than one) in preparation for the detailed design and coding stages of production; sign off the specification with the customer/client.

m. Identify appropriate authoring tool specialists and/or service providers and discuss the specification of the functionality of each module.

n. Identify appropriate graphic design service providers and discuss the required overall presentation of the learning materials with the customer/client.

o. Agree the milestones and associated demonstrations of modules; sign off the technical and functional specifications with the design service providers and then commission the design of the learning programme.

p. Track the module design process and apply quality assurance procedures to all stages of the design process.

q. Receive designed modules (and programme) and carry out testing of each part in accordance with the technical and functional specifications.

r. Receive module design and put through acceptance tests.

s. Review modules with peer subject experts and customer/client for completeness and pedagogical effectiveness.

t. Where possible, carry out a controlled release of the materials with a selected set of learners to identify any issues regarding the overall learning experience.

u. Sign off the developed learning materials with the customer/client.

46. All the above steps would be captured in a series of templates within a set of linked processes and could be part of a semi-automated set of tools provided by the e-U. The design and implementation of the toolset itself could be done by one or more specialist service providers, although the overall responsibility for the specification of the design would rest with the e-U – as would the critical quality-related tasks to establish the framework. Some aspects of the creative parts of the process could be assisted, or even provided, by the e-U itself. Detailed coding, using specialist authoring tools and graphic design activities could be outsourced to specialist suppliers. These production services can be supported by workflow tools available now and could be used to support the overall production environment.

47. Well defined, template-driven procedures would greatly assist for work which was outsourced to specialist suppliers. The templates would structure the processes associated with the workflow without constraining the creativity involved in the design of each task involved. Structuring in this way would provide the opportunity to design computer-based support tools that would enable the processes to be scaled to handle large volumes in module design. The parameters identified as relevant to each stage in the process would be identified and monitored. Some would relate to the quality of the task and would be needed to control the quality of the step in the overall process. In this way the quality of the whole process would be managed within an overall quality framework. Because the templates would be computer based, the whole process could be tracked – which would be an essential feature of quality audit procedures. For work outsourced to specialist organisations, they would be informed of the measures to be applied by the e-U in making quality judgements about their outputs.

48. Overall the whole set of processes and services would form the integrated framework of the production system for learning materials within the e-U. The tools and services themselves could also be used (under contract and at a price) by any external organisation which wished to produce their own materials to service their own markets. In many cases such tools and services can be used at a distance and delivered using standard networked technologies.

49. Learning programmes and modules would be subject to a final review process defined by the e-U's committee for academic quality to ensure they were fit for their purpose – as set out in our report. Where a learning programme led to a professional qualification, the awarding body would wish to ensure that it was also acceptable to the professional body. Accreditation of programmes would require external assessment of the whole learning experience in terms of its fitness for purpose in preparing the learner for professional practice.

Emerging international standards for learning materials

50. In recent years there has been considerable activity in developing standards to apply to the structure and delivery of commercial and academic learning programmes. The main concerns have arisen because of the high cost of bespoke courseware materials and the lack of usable standards for making courseware interoperable and reusable. 'Interoperable' is the term used for the multiple use of learning materials in different delivery systems; 'reusable' is the term used to describe multiple uses of the same learning modules in the context of different learning programmes. International standards, defined by the Institution of Electrical and Electronic Engineers (IEEE), generally emerge after a long process of detailed

consideration of the issues, by committees whose members are drawn from the academic and commercial communities. The major bodies involved have been:

- the IEEE Learning Technology Standards Committee (LTSC)
- the Aviation Industry CBT Committee (AICC)
- the Instructional Management Project (IMS)
- the EU 'ARIADNE' project
- the Advanced Distributed Learning (ADL) initiative of the US Department of Defence – 'SCORM' (Shareable Courseware Object Reference Model) recommendations
- the Microsoft Learning Resource Interchange (LRI) specification.

51. The work of these bodies has been extensive. The IEEE LTSC has been developing definitions of all aspects of learning technology drawing from the experiences of commercial companies and from the academic world. It introduced the broad definition of 'learning objects', and much subsequent thinking has assured their existence – although more work is still needed to define their granularity.

52. Other work, such as that of the AICC, has been driven by the requirements of a regulated industry where complex products require regular updates for all staff, from engineers through to marketing and sales. In Europe, the EU has made recommendations through the Learning Technologies Workshop (LTW) of the CEN/ISSS organisation (CEN - European Committee for Standardisation, ISSS - Information Society Standardisation System). In particular the LTW is working on localisation of the IEEE LTSC Learning Object Metadata (LOM) to take account of differences in culture and language throughout the EU. The work programme for the EU standards activities in the area of learning technologies has recently been published and contains recommendations on these issues.

53. The level of granularity of learning material units within the e-U is likely to change over time. At the outset it is likely that the size would be relatively large structures, perhaps even corresponding to learning modules taken by students (within the current curricular taxonomy of higher education courses). As experience with XML representations of learning materials becomes greater, the level of granularity of products may reduce in size so the learning modules have a sub-structure. Such a concept – of 'learning objects' – is already built into the standards being developed by the standards bodies mentioned earlier, although a formal definition of a learning object has yet to be included in the standards. If the standards were to be adopted, there is likely to be an accepted convention about the size of a learning object. The prospect of a learning object economy – with tools to construct, edit and link learning objects – is a real one if the market predictions for educational services are realistic.

54. The development of any form of global 'education industry' would be greatly facilitated by an agreed set of standards. The work of the various bodies is converging, and the publication of the SCORM recommendations by the US Defence Department in January 2000 was partly designed to accelerate this process and encourage commercial courseware

providers to adopt a compliance policy. The recommendations cover issues relating to the structuring of courseware from component parts as well as issues relating to the delivery of learning programmes from a server using a learning programme management system.

55. Probably the most far-reaching development, in relation to the future description of learning materials, has been the strong advocacy for the definition and use of the XML standard for representing the structure of courseware components. A generalised document represented in XML carries with it a description of its content and its structure. The SCORM recommendations are specific about the use of XML to represent the structure and to describe learning materials. The interchange of learning materials and the definition of open standards for learning materials would be greatly facilitated by the use of XML. The hope would then be that public and private repositories of learning materials and courseware components would be developed. There are also likely to be a number of significant developments in the functionality of tools for the design of XML-based learning materials in the short term, and this could fundamentally affect the way learning programmes are constructed.

56. Courseware components would carry with them rich metadata descriptions allowing degrees of tailoring not available with current generation tools and materials. The metadata descriptions of courseware components would facilitate searches when the material was stored in accessible databases and repositories. Nine categories of metadata elements are currently proposed by IEEE/IMS. The growing use of metadata to describe and structure generalised documents is leading to the concept of reusable information objects which would be relevant not just to learning materials but to all forms of documentation within an organisation. The impact of XML to facilitate the representation and the transfer of electronic documents is expected to play an important part in the growth of e-commerce and associated services.

57. The structure of learning materials should reflect the curricular taxonomies appropriate to the type of learning programmes. Where a university postgraduate course, say, is converted to being on-line, the design is likely to reflect the traditional structuring of the course. This has been the case in centres in the US and Australia when course modules have been converted to on-line versions. In centres where there has been a considerable amount of experience in running courses on-line (such as the Telelearning Network Project in Canada), the pedagogical issues associated with novel use of the technology are better understood, and programmes have been designed from the standpoint of the knowledge building experience. The e-U will wish to learn from such experience, and the design teams should explore best practice in developing their own design methods.

58. In summary, we would suggest that modules should have associated standards-based metadata descriptions and be stored within the e-U infrastructure. Learning modules would be stored in an e-U repository. Learning content would be categorised and accessed using a content asset management system. Delivery of a learning programme might be facilitated through a commercial Learning Management System, as part of the delivery platform, using commercial browser technology to supply a set of services to support the wider learning experience.

Innovation in developing learning materials

59. The convergence of the fundamental technologies associated with communications and computing will continue to influence the application of information technology. The

power/cost ratio for computation continues to rise, and the availability of broadband connection to the home and office is expected in the short term (in the US, Europe and selected areas elsewhere). All this prepares the ground for innovation in teaching and learning. Commercial courseware providers are already forming partnerships with universities and colleges to develop educational products. A competitive market for educational products is likely to follow these developments, but no one has yet explored the full extent of what is possible – even using the currently available technology.

60. The e-U would provide students with options for different levels of assistance with courseware materials. At the most basic level, learners should be able to use some e-U learning material with no or minimal (but on-line) assistance. At the other extreme, learners might choose to have regular access to an on-line tutor – for an assessed course, this might even be required. There are varying degrees of on-line assistance between these two levels.

61. The design of the courseware materials is the starting point for the development of the required learning experience. The tools now available to author courseware provide an ever growing number of ways to interact with the learner which will improve the effectiveness of the learning experience. More can be done in designing tutorial help into the way the material unfolds within the learning module itself. While context-sensitive help has been part of computer applications for some time, so far there has been only limited experimentation with more intelligent features in current applications. For example, the use of text and audio files to answer frequently asked questions could provide a more 'user-friendly' interface than is currently usual.

62. Work with 'software agents' is beginning to be used in the development of learning environments. For example, the Microsoft intelligent agent tools have been used in one application and, coupled with speech recognition and synthesis, provide an effective environment for language teaching. The authoring systems employing agent technology require careful analysis of likely scenarios for learners, to enable the agent to anticipate difficulties and build in appropriate advice. We think that such intelligent assistance should be built directly into the design of e-U learning materials during their production stages.

63. The recommendations of the Advanced Distributed Learning initiative (SCORM) point to the need for learning management systems to communicate actively with the learning material as it is executed by the learner. Working in this way, the learning management system can provide valuable information about the way the learner interacts with the learning material. The operations of the e-U will provide a new opportunity to create pedagogical tools to study the effectiveness of different innovations in the design of learning materials. The internal evaluation of programmes can then be based more on data derived from the actual usage of programmes.

4 Commissioning of courseware

64. Our report suggests that the initial market for e-U courseware products is expected to be CPD and related professional development opportunities, together with some postgraduate offerings. Customers of the e-U might be individuals, companies, HEIs or governments. The front line products of the e-U will be the provision of courseware materials – as well as tools and services relating to the development of, and access to, various forms of learning services.

On the supply side, the e-U will need to operate within a broadly commercial framework for commissioning the design of materials in accordance with its standards and quality procedures.

65. The process by which the e-U sought to commission the development of course materials for learning programmes would be flexible. It could be through a bidding process, through the use of broker services or by direct approaches to HEIs, subject experts (individually or in groups), or private companies. Alternatively an HEI (or any other potential provider) could approach the e-U with a proposition to create a learning programme for the requirements of an identified market. The e-U would normally be prepared to invest in only one module for any given topic and for any one specified market. It would try to ensure that its investment was the 'best of breed' within the UK system. The production of certain generic modules would simplify the creation of subsequent new material and would also stimulate the learning object economy referred to above.

66. Suppliers of content to the e-U will fall into several categories, including:

- private training companies
- HEIs, departments, multi-media centres, etc
- media companies and other content-rich organisations
- subject experts, either individually or in groups
- public content repositories
- content and learning material exchanges.

67. Any such supplier would enter into an agreement with the e-U and would be expected to work within the production framework to ensure standards for the integration of courseware materials. The e-U would provide administrative procedures as part of its production framework. The central e-U might make available a design team, either in-house or contracted, to help the supplier with the design of the learning programme. The supplier would either use its own subject experts or would contract with other subject experts, directly or through their employer, for assistance with the development of the learning programme. Prior agreements would determine the intellectual property rights as well as the resulting distribution of generated income. The e-U would take delivery of the resulting material and conduct a final quality acceptance test.

68. Once a particular programme had been structured and its technical and functional specification completed, the coding of the material could be outsourced to appropriate suppliers. The e-U would maintain a list of preferred suppliers for design services that would be subject to periodic review. In this way, the e-U would be in a position to manage the production of quality materials without the need to employ large numbers of programmers and authoring tool experts.

69. The commercial aspects of commissioning learning material should be based on normal contractual principles. Funding for the work could come both from the e-U and, to varying

degrees, from other contributing parties and/or from private investors. Customers and clients of the e-U would enter commercial agreements of various kinds for the delivery of learning programmes.

70. A particularly interesting source of material could be the large media-rich organisations – some of which are already showing interest in potential markets for the conversion of their content into a form applicable to learning programmes. Repositories of content could be formed and made available for use in the development of new learning programmes. Partnerships with such organisations and joint developments would be possible as the e-U would be a good potential partner for such organisations.

71. The growth of the education market may lead to increasing opportunities for the exchange of learning materials (both into and out of the e-U repository). Exchanges are closely related to the development of e-commerce services, and learning services would be just one of the range of services available to the professional in the workplace. Content exchanges would facilitate the transfer of learning material between repositories as searches were made for materials in the construction of specialised and tailored learning programmes. In this way we expect to see the growth of a market for learning materials as part of the more general development of e-commerce services.

Content asset management facilities

72. Some of the materials produced under the auspices of the e-U would be fully owned by the e-U itself, others would be wholly owned by their producers, but most would be in between. Even where ownership of the material lay outside the e-U, there would be occasions where it could be used in the construction of new e-U programmes. Where possible, the re-use of courseware materials could represent a significant saving of development costs. It could also lead to the generation of an income stream from the licensing of modules.

73. For this to be done efficiently, available material would need to be properly described (using standards-based metadata) and stored in one or more databases or repositories in ways which could be searched. The e-U would keep a repository of all the material produced under its auspices and which satisfied its quality criteria. There would be an advantage in a second tier central repository of all e-learning material, and the e-U would clearly be a candidate for holding it – although it would have to make a clear disclaimer about its quality.

74. Repositories are at the heart of a content asset management system. In the case of the e-U, the content would be of modules of learning materials and /or associated learning programmes and, over time, of learning objects too. The infrastructure services of the e-U should therefore include a learning content repository and associated search functions to keep track of these valuable assets as they were accumulated. As the granularity of the components of learning programmes was reduced, so the number of components in any specific programme would grow. Equally, as the degree of personalisation and tailoring of learning programmes increased, so would the number of components from which learning programmes could be built. Metadata descriptions of learning components would provide ways of distinguishing between different styles of learning and different competence profiles of learners. All this information could be available to the learning programme design teams and could be reflected in the functionality of the tools used to access the repositories.

75. As not all learners will have access to high end computing equipment with full multi-media capability, there may need to be some tailoring of components of the learning programme to match delivery environments. This would be easier if the relevant information was contained in the description of the learning materials held in the repository. A rich description of learning material would also be required if components were to be re-used in different forms, perhaps as part of a more general knowledge management system within an organisation.

Ownership of on-line course materials

76. Ownership of materials and IPR will be major issues for the e-U, and will be among the key factors that will determine the success or otherwise of the business model.

77. There would seem to be three basic approaches:

a. The e-U could invest in the production of a module by paying for its production, including fees to the various contributors; the e-U would own it and its IPR and would receive any subsequent payment for its use.

b. The producer(s) of a module could fund the production themselves – including paying the e-U for its services, would retain ownership (and IPR) and would then receive the payments for its use. The producers would pay some ongoing fee to the e-U for making the module part of the e-U portfolio.

c. The middle road, in which the investment would be shared and therefore IPR and income shared on an agreed basis.

78. In all cases the module would need to satisfy the e-U's quality requirements operated by its committee for academic quality, and the prospective learner should not be able to detect a difference in source (so, for example, there would need to be consistent pricing).

79. The model may well change over time. In the start-up period, the e-U itself is likely to pump prime a significant part of the funding for module production which would normally result in the module belonging to the e-U. We would anticipate that, as the tools and design services become more widely available (and accepted), and as the e-U brand became established and was shown to work, producers would be willing and able to invest their own funds in material development in order to access the e-U infrastructure.

80. In the past the issue of ownership of course materials (and the related issue of copyright) has not received a great deal of attention. Now that there is the prospect of taking lectures, re-packaging them in digital form and distributing them on the internet, their value is more recognised – although not all courses would generate net income even if they were converted to such a compelling interactive form. HEIs are looking into the conditions under which part of the newly recognised value of the course can be attributed to, and so claimed by, the institution.

81. The arguments in this debate are complex and interacting. Should academic staff be encouraged to seek to use new technology and to find interesting and novel ways to teach the subject? To what degree should HEIs seek to limit such work undertaken by academic staff

outside their commitment to the institution? Should HEIs seek to own the intellectual property associated with the creative interpretation of knowledge and its presentation to learners carried out by their own academic staff in the course of their research and teaching? These are examples of the issues being raised and for which several institutions are seeking to put new policies in place.

82. These matters will be of great interest to members of the academic and administrative communities in HEIs in the UK and elsewhere. We already have examples of collaborative ventures that span the Atlantic, and there may well be differences in the way the ownership of material is interpreted. It is clearly a matter for which the e-U will need to have a policy as part of the agreement with individuals and with universities and colleges.

5 Supporting on-line learning

83. The products of the e-U will be delivered in different ways to match the differing requirements of learners. Some learners will require small quantities of learning material delivered in a short period of time in the professional workplace. Others will want to learn over a longer period of time, especially if a qualification is sought at the end of the programme. Many learners will require support on-line, but the form of the support is likely to vary according to the type of programme and the category of learner. At one end of the scale, a learner may not require any support other than what was already built into the design of the learning material. At the other end of the scale, there will be learners who will require considerable support on a day-to-day basis (for which they would pay). The e-U concept will need to facilitate these various forms and levels of support for learners.

84. A distinction can be made between on-line support through a general information centre and on-line support through tuition for a specific learning programme – perhaps coupled with community and peer group interactions. In any case, the learning experience will probably involve not only interaction with the learning material but also activities in libraries, in laboratories, in learning centres and in the workplace.

85. In general, a learner might expect to find a number of services available through the e-U. Services might fall into the following categories:

- tutorial support for learning
- assessments, schedules and arrangements
- library services and access to other learning facilities
- wider services.

86. These are covered in the following sub-sections.

Learning support services

87. Our report suggests that the e-U will make available a range of tutorial support services so that learners can choose (and be advised on) the level of support most suited to their particular circumstances. Any such service provided by on-line tutors would be within a framework of style and quality set by the e-U as part of its brand definition. The services would be quality assured though the committee for academic quality. A potential service provider would have to satisfy the committee on matters relating to educational level, experience and competence in working with students. The e-U could require providers to be accredited by means of an e-U approved or produced training package.

88. Services available could include specific forms of interaction – including on-line communication, telephone support and even face-to-face tutorial support in specific situations. Tutorial services might also provide comment and feedback on student assessments; for courses leading to an award, this might be obligatory for the learner. Tutors should monitor their own performance, for example through feedback, and training updates could be provided to ensure that their standard was maintained at a high level.

89. There are several examples in the US where the tutor runs on-line help directly. Tutors using these facilities report considerable success if the conversations are properly mediated, and encouragement given to students to participate in the discussion. Using this technology with groups of up to 30 participants can generate a community feeling in the group. Other centres are proposing to use such facilities in seminar mode, where the numbers of participants can be significantly higher. The e-U will wish to explore how such technology might be used in its provision.

90. Peer group interaction can also be helpful between learners by providing a feeling of belonging to a learning community. There are many forms of on-line interaction that have gained popularity in recent years, including e-mail, bulletin boards and chat rooms. More recently, the advent of mediated web-conference services has provided a useful and effective way to make presentations and create discussions which bring together geographically dispersed participants. Other products allow shared whiteboard facilities on-line so that learners in different geographical spaces can share the same writing space to encourage discussion.

91. Video links are also possible, even over current modem connections, but the quality is poor compared with traditional video conferencing. The expected increase in bandwidth will provide greater opportunities for groupware products in the short term (in some developed countries). For the present, mediated web discussions and e-mail can provide sufficient interaction between learners to generate effective communications to support the community aspects of learning amongst those in a cohort.

92. As a teaching tool, computer-mediated conference or collaboration (CMC) has been used with varying degrees of success. There are advocates of it in the US who report considerable success in encouraging students to participate actively in threaded discussions and thereby join in the knowledge building and the understanding process. The role of the tutor is critical in moderating the discussions, particularly in knowing when to stimulate the discussion and when just to let it move discursively.

93. To back up the tutorial support which is built into some learning materials, on-line training companies are already providing live 'chat' assistance to learners. As the learner progresses through the courseware, there is the opportunity to ask questions by selecting the associated 'chat' channel in the toolbar. In response, a chat window opens and the learner is greeted and invited to describe the assistance sought, in text form. The person who answers the questions is part of a call centre and is specifically trained to answer questions about the courseware. An e-conversation between the learner and the mentor can proceed at an acceptable rate even with the slow speed connection via a modem. If the mentor is unable to answer a question, it is referred to a tutor with superior subject expertise, who returns a full answer to the learner by e-mail within a set period. In a university environment, the first level mentors are the equivalent of teaching assistants.

94. Dedicated chat facilities are now used for several types of internet-based services, and text may be replaced by voice as the voice-over Internet Protocol (IP) technology becomes more widely available (although text requires questions to be phrased with more thought). Some on-line educational support is also often provided using telephone services and e-mail messages. The success of this form of support will depend on the competence and dedication of those providing the service. It is not something that can be done without specific training, and the e-U should require specific service contracts with those offering this form of service.

95. Other products are now appearing that make use of artificial intelligence algorithms to track and personalise general web interactions, so that users can rely on tools which automatically search for items of interest to them. Little has yet been done to explore the use of similar techniques in learning and teaching applications, but doubtless these products will soon appear in the market.

96. For the e-U, on-line tutoring services may be provided in a number of ways depending upon how the market develops. Just as there are specialist assessment service providers, so we can expect to find specialist services established to tutor specific subject areas – as is already happening in the US. An HEI may decide to be a service provider of this type and offer specially trained on-line tutors to answer questions from learners in specified subject areas. Such services could be offered on a commercial basis and would operate to an agreed level of service.

97. For learning support, it may be sufficient for the checks by the committee for academic quality to cover the quality and training of the proposed tutors and the proposed method of operating (including the means of obtaining and responding to feedback); and to check subsequent feedback from user surveys (the market operation will also provide post-hoc checks) – including the possibility of providers being removed from the approved list.

98. Having specified the quality criteria for on-line tutor support and the tools for it, the e-U would be in a position to quality assure aspiring service providers – which could include commercial ones (such as Tutor.com or Smarthinking). It could set up an approved database of providers of tutorial support (individual HEIs, consortia, private companies, or arrangements with local back-up) who had satisfied the committee for academic quality criteria. Providers of support could limit themselves to a few specific modules (eg ones that they had produced) or could be more generic (eg by subject area). Providers would need to specify the type of support they were able to offer (eg 7 days x 24 hours, e-mail, call centres, languages, if face-to-face support then how and where) and their charges. The extent to which providers were used would be driven by learners' demands – apart from those learners

seeking an award, for whom the awarding body might require a specified level of tutor involvement.

99. Some HEIs are using e-moderation as a teaching tool as they develop their on-line teaching. They report significant gains in terms of active student participation if the mediation is correctly applied. To use e-moderation effectively in on-line teaching, the moderator needs to be trained in using the method. It combines various skills including teaching, interpersonal skills, technical skills, techniques and content expertise. Analysis of the transcripts of threaded conversations in a mediated environment can provide an important record of the way knowledge is built up among the group of collaborating learners.

100. Tutors providing any form of on-line support to learners will in turn require their own support and, in particular, will need training in the use of the technology for teaching and learning. They will themselves also form a community and as such will wish to communicate with each other to discuss best practice. Tutors working with learners will also need to have information about the learners. This will require the administrative systems of the e-U to contain sufficient functionality to build a 'cohort view' to supply relevant information to (and about) the tutor. In addition, the tutor and learner will each need an easy-to-use interface so that the technology does not get in the way and detract from the teaching and learning issues.

101. The e-U should work with the suppliers of such services to define appropriate functionality to maximise the effectiveness of tutors working on-line and to enrich the learning experience for both tutors and learners. For support based on 'call centre' technology and applied on-line, the e-U should define the service requirements with specialist suppliers.

102. Tutor support arranged under the auspices of the e-U, and the way in which it is perceived by learners, will quickly determine the success of a learning programme or module. The e-U thus needs to set and monitor the effectiveness of the tutor-learner interface.

103. The e-U may also wish to offer counselling and pastoral services to learners using material or services provided under its auspices. Such services could be provided as part of a general set of services made available to learners through the on-line learning environment or through telephone contact. A range of other services for learners is likely to become available from private suppliers, some of which are already evident in the US from suppliers such as StudentAdvantage and VarsityBooks. There may be opportunities for the e-U to negotiate special provision with suppliers in return for their inclusion in the e-U learning environment.

Learning assessment and awards

104. The specification of a module of learning for the e-U would include a definition of the outcomes of the learning experience in terms of what the learner should know and/or be able to do on completion of the module. Instructional designers would work with the subject experts to convert concepts and knowledge into illustrations, actions and activities to illustrate, conceptualise and reinforce the understanding of the topic.

105. For each module there will be assessments to exercise the learner. These would be designed and built into the module and should be matched to criteria that test that the learning objectives have been achieved. Formative assessments would take place during the learning process, designed to provide feedback to both learner and tutor (if any) in monitoring progress. Summative assessment would take place at the end of a course or module.

Understanding also derives from shared experience and discourse amongst peers and mentors, so analysis of the transcripts of mediated collaboration sessions could provide insight into the way understanding was built from tutorial, group and other interactions.

106. Some assessments could be carried out on-line. There are already many examples of on-line learning where formative assessment exercises have been included within the design of the learning materials. External forms of assessment (ie not simply self-assessment) would normally be required to test the learners' comprehension, application, synthesis and evaluation of knowledge. Such assessments could be by means of assignments posted on-line or through an examination. We expect further innovation in the forms of assessment that could be built into the design of the learning materials as the technology develops.

107. Where the completion of the learning was intended to lead to an award, it would be necessary for the awarding body to use its own approved assessment methods. Tutor-marked assignments are used in many distance education programmes. The e-U would need to provide the infrastructure to support tutor-marked assignments as part of the learning programme tools and services. Although opportunities exist for outsourcing the administration of the assessment process, responsibility for the content of the assessment would clearly be that of the awarding body. The e-U framework could define the quality requirements for the outsourcing of assessment processes, especially if they also involved the service of marking assignments (as exam boards do for their examiners).

108. It would be possible for HEIs to offer assessment services to the e-U, and there are private companies and others which already provide these services – such as the British Council and private sector suppliers such as Sylvan and QuestionMark. Sylvan is able to administer secure testing both for educational organisations and for companies. Its services include on-line testing and face-to-face testing at learning centres worldwide in over 3,500 testing centres in 128 countries and with 10 call centres operating in 25 different languages. QuestionMark offers services and tools for the design of on-line tests and operates in 40 countries. The software it provides enables users to write, deliver and mark tests and questionnaires. As the demand for these services increases, new assessment service providers will arise offering innovative products and services both in the UK and overseas.

109. Any such service providers which the e-U was prepared to endorse would, as with the other e-U services, have to satisfy the quality requirements set by the e-U. Specific quality measures would need to be established to support the authenticity of the processes, for example to demonstrate anti-cheating devices (eg through real time discussions or calibration of a learner's style). The design of assessment systems to match the learning provision would be a function on which the e-U could advise those putting together learning modules – although the final responsibility would, of course, be that of the awarding body itself. The methods available should be evaluated regularly as part of the quality management of the e-U.

110. Some learning materials would have been developed by more than one institution. If such material were aimed at an award, the contributing parties would need to agree beforehand which of them was to take responsibility for the award: there may be legal issues involved. Others may also have an interest if the award was to be accredited by a professional body. There are also national differences in the way professional bodies handle the accreditation of qualifications. The e-U could help UK institution(s) to decide how best to meet any such overseas requirements.

111. Stand-alone learning materials not designed as part of an awardbearing programme would still include assessments as on-line exercises and perhaps also as tutor-marked assignments, not least because they would be available to potential learners and to other design teams for inclusion in learning programmes which might lead to an award. The aggregation of modules from various sources would be a task for which most learners would need assistance – this would be the role of the navigator service, as explained in our report.

112. Over time, as noted in our report, this could lead to a system of agreed credits and/or to institutions being prepared to make awards on the basis of a learner's performance in examinations. We do not think either possibility should be ruled out. Nor should the possibility of the e-U itself becoming an awarding body for some multi-sourced programmes.

Library services

113. Part of the educational process involves scholarship requiring access to wider resources for research and the integration of knowledge. In traditional courses, students are able to access vast resources in the libraries associated with their institution. Many university and college libraries are already heavily involved in securing access to resources on-line following the publication of recommendations contained in the Follett Report some years ago. The work of UKOLN (UK Office for Library and Information Networking) is the focus for co-ordinating much of the effort in creating digital libraries and dealing with the problems associated with interoperability in securing access to national and international resources.

114. Many HEIs in the UK are supporting their own distance education programmes which require them to establish access to library provision for students working at a distance. Some have set up units within the library structure specifically to accommodate the requirements of remote access to resources, sometimes through their web-sites. Such services are an important part of the support for on-line learners, and access to library provision should be a high priority for e-U. This is another area where there is considerable scope for services to be provided by external organisations.

115. There are also current public sector projects in the UK to provide an integrated approach to the use of information and communications technology within local government. These include broadband initiatives to support local and community grids for learning incorporating education establishments, learning centres, libraries, hospitals, museums, galleries and leisure services. Plans for these facilities are well advanced. For example, in the West Midlands region they involve the creation of a high-speed core network capable of carrying concurrent live video, audio and data traffic, and supporting multiple secure Private Virtual Networks (to service communities of common interest) across the same physical network. The intention is that these networks will initially be used for library and school connections and later connect to other services. Extension of the facility to other regions is a logical next step, eventually linking to a national network of services. The major journal publishers have also already moved to the point where most mainstream journals are now available to subscribers on-line.

116. In the US there are a number of interesting developments designed to provide greater opportunity for on-line learners to access library resources. There are moves to digitise and make available on-line the text of hundreds of thousands of books. Questia, founded in 1998, is intending to provide students with access to 50,000 text books when it opens next spring, with a goal of 250,000 books on-line within 3 years. Ebray plans to launch shortly: it claims

to have some 300,000 volumes already on its demonstration database and expects some 600,000 by the time it is launched. Although access and search is expected to be freely available, the user would be charged to download material.

117. With predictions of strong growth in the market for e-books, there will be more organisations and companies offering these services in the future. There will be opportunities for the e-U to form alliances with such organisations and to work with them to define other specialist services which relate to the products to be offered by the e-U. The simplest arrangement might be for links to company web-sites within the learning environment. There may well also be opportunities to provide study packs of pre-researched resources and specialised search facilities in defined subject areas. All such opportunities should be investigated by the e-U with a view to negotiating an acceptable level of service to back up its learning material.

Learning programme management

118. The remaining services are mainly concerned with the management of information about on-line learners. At least initially, the e-U will not have any students which it 'owns' in the sense that a traditional HEI does. Its requirements for systems will thus be very different from theirs. Current vendors of Learning Management Systems (primarily for companies) provide functions that link to the human resources (HR) and financial systems of the organisation and maintain a record of the learning experiences of the staff. Some go further and provide functionality to link learning content products with the process of promoting interventions for learners, following a 'gap analysis' of an individual's knowledge and skills within a competence framework. Tailored and personalised learning programmes are becoming more standard in HR departments, and the ability to custom design learning programmes is a new goal of those who provide learning programmes.

119. The administration of on-line learning for learners taking e-U modules will depend on the extent to which the e-U becomes directly involved with the student experience itself, but, as a minimum, will need to help track what learners are using in order to arrange billing and to receive income. A complete auditable record of the transactions involving the components of learning programmes would be needed to take proper account of IPR, copyrights and royalty payments.

120. As the amount of e-learning material grows, so will the task of keeping track of the content assets. We have mentioned earlier the need for a content asset management system in connection with the establishment of repositories of learning programme components. Content asset management will also help the task of building whole learning programmes. The e-U should demonstrate very effective management of its learning material – which will belong to a variety of sources in varying degrees. Whatever the ownership, these materials should be subject to rigorous inventory and tracking requirements associated with their IPR and with e-commerce transactions.

Annex 4

Technology aspects of the e-U

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1 Introduction and summary

1. The purpose of this annex is to provide a description of the technology issues that will affect the design, implementation and future operations of the e-U. This annex aims to discuss the technology options open to the e-U and make recommendations where possible. Finally, a section is included giving a background to outside developments in technology.

2. The e-U aims to offer a world class learning programme to many students across the globe. It also intends to assemble learning content, modules and support services from multiple providers predominantly based in UK higher education institutions (HEIs). In order to achieve this, the e-U will be designed to be agile enough to adapt to potentially large changes in demand, market size and technology. The underlying technology to support this type of operation must be responsive, flexible, scalable and secure.

3. The e-U technology platform will need to be accessed by many parties with differing technical skills and access to technology. As a consequence of being a global, multi-party system, the e-U technology platform must be developed using an open architecture which encourages interoperability between parties and is not exclusive.

4. Learning technologies will improve well beyond what is currently available, to offer a highly interactive learning experience. Internet technologies such as broadband (which allows faster connection and transmission of data over the internet) are developing to enable more interactive and content-rich experiences which will feel more like that on TV. In the future we foresee that concerns about technology capabilities will become secondary to actually providing a meaningful experience, to the point where the fact that a service is offered over the internet will, effectively, make little difference.

5. In order to provide an excellent service to learners and to streamline its back office systems, the e-U must make full use of the new e-learning technologies such as Content Asset Management and Learning Management Systems. Technologies such as these will be developing very fast in the next few years, and will provide one of the main differentiators between the e-U and its competitors. The e-U may wish to invest in research and development into niche technologies to keep abreast of, and even initiate, innovations in e-learning technology.

6. To ensure easy and secure transfer of information between the e-U and its partners it is likely that a secure-access extranet will be needed for partner operations. This extranet would allow multiple organisations to access private information either via the public internet, or via the higher education network JANET.

7. Some technology factors, which lie outside the e-U's control, will have a significant impact. Technology trends, such as the advent of the internet via wireless and digital TV channels, will affect the e-U's operations fundamentally. Broadband technology is also being introduced in many parts of the world but at differing speeds. As a consequence of these changes, the e-U will need to keep up by offering the best e-learning content and services in the medium required by the market. It is not hard to envisage the same content being packaged for access via multiple channels, with different qualities of delivery and at different speeds depending on where the learner is in the world. It will be the e-U's task to ensure that all its services, including administrative services, are excellent and take full advantage of the technology opportunities available.

8. The operations of the e-U will be very complex. It is therefore likely that a bespoke software solutions provider will be needed to create the basic platform to support the e-U. However, the process for determining procurement methods, outlined in section 3 of this annex, should be followed to decide if this is the right course to take. Procurement will involve defining an overall functionality specification (which needs to link with all business functions) and then selecting the right solutions providers and working with them to develop the system. Some off-the-shelf applications may be used for more common e-U functions such as e-commerce or finance.

Objectives

9. The technology options and recommendations in this annex have been based on the business model developed so far in the main report. The following sections illustrate the high-level functionality requirements of the e-U and a suggested physical systems architecture. These have been included at the outset to provide context for the main report and a basic summary of the components of the e-U's technology platform.

e-U functionality diagram

10. Figure 1 below illustrates the role that the e-U organisation will play in dealing both with students and with HEIs and other partners.

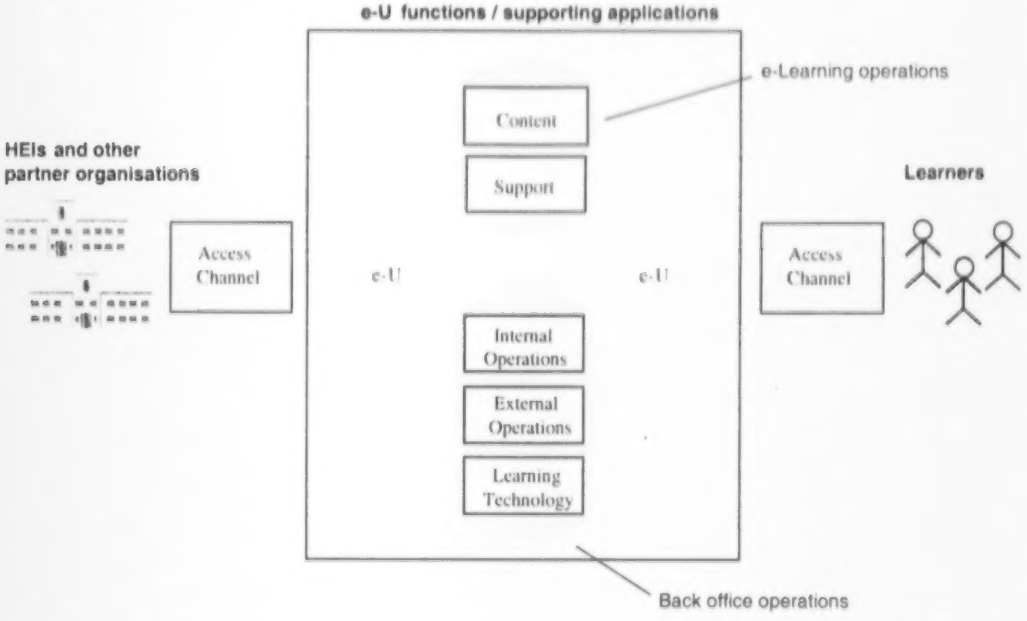

Figure 1 e-U Functionality

11. The e-U would make available to learners the learning materials produced by HEIs and others. In some ways the e-U could be seen to be a facilitator but it is more than that –insofar as it would add value whilst managing the interfaces between learners and content providers. The technology is instrumental in enabling the e-U to add such value.

12. The e-U will also need to perform some administrative functions that are customer facing (such as payment) as well as the back office operations that support the business.

Technology which takes full advantage of the internet would play a key part in these operations.

e-U Systems architecture

13. Figure 2 below shows a possible architecture for the hardware and network infrastructure of the e-U.

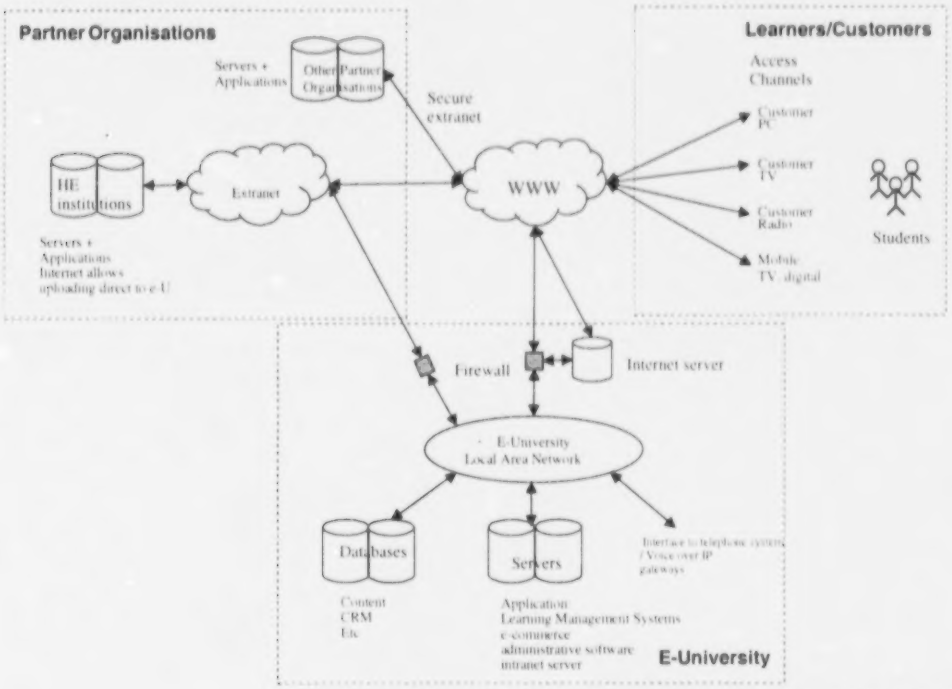

Figure 2 Possible e-U Systems Architecture

14. The e-U network should link all its applications and stored information, and be based on an open architecture. It should have secure connections both to the partner organisation extranet and to the internet. The firewalls indicated would be one of the security measures used to protect the valuable content assets of the e-U.

15. Partner organisations would use applications that can easily exchange information with the e-U over the extranet. In some cases the partner organisations would upload material direct to the internet for access by students.

16. The students would be able to access the learning materials and administrative e-U services via any number of channels. In the future it is likely that students will demand access over wireless and digital TV as well as PC.

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2 e-learning technology

17. Advances in the overall capabilities of technology will serve as a catalyst for acceptance of e-learning technologies. Concerns about technology capabilities will become secondary to providing a meaningful experience as, in time, the fact that a service is offered over the internet will, effectively, make little difference. This is sometimes referred to as 'losing the e'.

18. As e-learning technology evolves we would expect the e-U to have the following technical functionality within 10 years:

- full learning on-demand capability
- high quality content at low cost
- wide acceptance of 'object based' content standards
- sophisticated, low cost e-tools to help develop content
- tracked network learning
- correlation of learning to individual and enterprise performance
- easy to use, sophisticated interactive technologies
- thriving e-commerce in learning and training content.

19. This section identifies and describes the main types of application that would be required to support this functionality. It also considers the ways in which the e-U can best achieve this level of technical capability, not only for its central operations but also for its partner HEIs and other organisations.

20. 'Learning objects' and e-tools, which are instrumental in the production of e-learning content, are covered in Annex 3.

21. Standards are being developed for e-learning technology. The US based IMS Global Learning Consortium is the most advanced, and is widely supported by vendors and buyers alike.

Learning Management Systems

22. A Learning Management System (LMS) will be critical to the success of the e-U because it will enable component learning materials to be assembled into a customised learning programme for an individual. The LMS is the system that interfaces with the learner, determines his or her needs, selects the appropriate learning application and content to satisfy those needs, and then delivers it to the learner. Somewhat simplistically, the LMS, supplemented with the navigator as appropriate, is rather like a maitre d' of a restaurant. In the same way that a good maitre d' will first establish where the diner wants to be seated, and whether he wants a meal or just drinks, and then guide him to a suitable table, the LMS will choose and present the appropriate application and content to the learner. Furthermore once the maitre d' has ascertained some of the diner's preferences he may make menu or wine suggestions based on his knowledge of the restaurant's wine cellar and specials for the day. Similarly the LMS has the 'intelligence' to establish what the learner needs (often the learner may not know), and using its knowledge of the content and learning materials available it is

able to suggest what the learner might best do next. In this somewhat clumsy analogy, the LMS is the front-man; rather than the chef who creates the food – the main reason the diners are there.

23. An LMS would help carry out pre-assessments and then manage and assemble an entire course. Most importantly it would also help track and monitor an individual's learning programme taking into account the learner's existing proficiencies, job role, learning objectives, style and preferred delivery. The LMS would be used to monitor an individual's progress over a learning programme, and also over a long period of time (suitable for lifelong learners).

24. In this way the LMS would assist the navigator in offering a more personal and useful service to the student.

25. The other aspect of the LMS functions is those services that would be provided to tutors and to content providers. The LMS could help manage the design and editing of courses by the provider. It would also provide useful feedback (such as learner progress, attendance, etc) to the tutor.

26. Learning Management Systems must have a close interface with the other administrative functions of the e-U. The administrative operations of the e-U are covered in detail in section 3 of this annex, however it is important to note that the LMS will need to exchange data, such as financial and management reporting data, with the administration systems. Based on this information the e-U management will be able to further support both learners and tutors.

27. Some of the typical features of an LMS include:

a. Assessments for learners to test skill and design learning programmes. Some LMSs provide self-testing to assess progress.

b. Available learning programmes with options. The LMS will present suitable learning for the students based on their preferences, skills, etc. The navigator will supplement the LMS (particularly on softer issues) in providing advice on course choices.

c. Course outline. A schedule with an overview of the course structure with timetable, facilities, modules, tutor contact information, etc.

d. Portal front-end/navigator. This is the visual and guiding interface that leads the learner through the learning experience. It is designed in such a way that it presents the right feature at the right time, and with the same look and feel to ensure the student perceives the e-U as a seamless operation.

e. Individual learner record. Information recording the performance of the learner, and records of any transactions between the learner and the e-U.

f. Community tools such as noticeboards, learner group information, introduction to other learners, alumni services, etc.

g. e-learning tools specifically to aid in learning (not administration). These might include conferencing tools for discussion groups, synchronous collaboration tools such as electronic whiteboards, and multimedia resources such as 3-D simulations, which may be live or downloaded.

h. Search and bookmarking tools.

i. Tutor upload areas for coursework. Also facilities for tutors to amend coursework materials.

j. Tutor access to learner records (on progress, attendance and so on).

k. Tutor communication with specific learners: a facility to help tutors communicate direct with their students in groups or individually.

28. There are many providers of LMSs currently offering state of the art solutions. Along with the recommendations regarding procurement below, we suggest that the first step to selecting either a bespoke or off-the-shelf LMS is to determine the full functionality requirements of the e-U. We strongly recommend that the functionality is determined not only for the initial offering, but also, as far as possible, with a view to possible future developments both external and internal to the e-U.

LMS standards

29. It is crucial that the LMS should be able to operate with content and tools from multiple sources. Several standards are being developed in this area which:

- allow material to be moved from one computer managed instruction (CMI) system to another, while maintaining its ease of use and functionality
- make it easier for learning technologies to be implemented on various types of browsers and operating systems
- establish a protocol that aids communication between software tools (such as spreadsheets and text editors) that a learner is using, and the instructional software agents that provide guidance to the learner.

30. The technical standard that is emerging as the format for the exchange of e-learning information over the internet is XML (Extensible Mark-up Language). XML is a standard that is able to identify content (not just formatting) and thus enables a specific piece of content to be identified for use by the LMS when needed for a bespoke learning course.

Content Asset Management

31. The e-U's modular approach should provide the facility for individual courses to be assembled on a basis specific to the individual customer. Starting from the production of modules of learning, the evolution to a granularity of learning objects may take place over time. Either way the e-U should take advantage of sharing learning modules or re-using content; all this information will then need to be managed. Content Asset Management allows vast amounts of valuable data to be stored and accessed very quickly and accurately.

32. It is likely that the content will be stored in central databases and possibly also in dispersed repositories amongst some e-U partners. This will include not just completed content but also content under development. In order to manage the learning materials it will be essential for them to be properly described using standards-based metadata. Metadata is an information tag attached to content material that provides a description of that content. To provide a rich description suited to the anticipated requirements of the e-U, it is likely that the following information will be needed in the metadata:

- subject or topic area
- level and context within different types of programme

- authors and design team
- date of most recent update
- price (which might vary by user, geography, etc)
- style of content (for example, is it suited to users who prefer a very interactive and highly supported type of course)
- language(s)
- type of technology delivery (for example, is it suitable for PC, and/or WAP technology).

33. Content Asset Management Systems contain powerful search facilities to allow the right learning material to be found quickly. The system would support the Learning Management System and its navigator in assembling learning courses.

34. As the degree of personalisation and tailoring of learning programmes increases, so will the number of components from which learning programmes can be assembled. As a result, the role of the Content Asset Management system will become central to the success of the e-U.

Collaboration tools

35. Collaboration tools include internet applications for virtual classrooms, on-line presentations and web meetings. Current technology now allows live collaboration over the internet. The e-U would expect to see material producers use collaboration tools in their content modules, as well as for advanced support such as live, voice-enabled meetings between learners and tutors.

36. In the future the e-U may wish to offer live collaboration tools for some of the provision made under its auspices. Live collaboration tools allow integration of voice, video, interactive tools and shared workspace, eg for one-to-one or one-to-many live events.

Application Service Provider model

37. Application Service Providers (ASPs) host software applications on their own servers for others to access them remotely via a web browser. Using an ASP may be particularly suitable for educational institutions looking to gain access to a wide variety of e-based learning applications at reasonable cost and maintenance effort. Although ASPs are not yet used widely, especially in the education and training industries, there are a number of vendors now pursuing this strategy.

38. There are several compelling reasons to adopt the ASP model:

a. IT personnel shortage. IT staff are in great demand and are therefore difficult to find and retain. Furthermore, every new member of staff needs to be brought up to speed on the systems to be managed. Outsourcing the day-to-day management and maintenance of learning applications relieves the IT department of that burden.

b. Modernisation and distribution of innovation. As technology is constantly evolving and developing it will be difficult for organisations to keep up with the latest software. An ASP, which represents the IT needs of many different organisations, will be able to keep abreast of the newest technologies and offer them to its clients.

c. Fast, affordable implementation. The customer does not have to buy the software or the equipment used to run it (servers, operating systems, and so on), therefore saving time and effort. Also, an ASP-delivered application is generally much quicker to get up and running compared with the time it would take an organisation to install it itself. This time saving frees up staff.

d. Ubiquitous access. Since the application is delivered via a Web browser, learners would be able to access it not only from their desk at the office, but also from home, their laptop, or an internet café.

39. There are several options open to the e-U with regard to ASPs. The e-U could itself become an ASP and host the most up-to-date software applications on behalf of all its partner institutions. The major benefits of this would be that, by providing a service to partner HEIs the e-U could ensure that the overall offering to students uses the same high standard of specialist software with the same look and feel. It would also help to encourage HEIs to make use of the e-U facilities if they had previously had doubts about meeting its IT requirements.

40. Alternatively, the e-U could decide to outsource its IT requirements to a third party ASP. The advantage of this would be that the e-U itself would spend less effort on IT, although it may be no cheaper. One consideration is that the technology will be a very important facet of the e-U, and as such, the e-U may wish to keep full control of it in-house. A further consideration is that, despite future predictions, the e-learning market is still relatively small and so it is doubtful if an external ASP would be able to provide a cost-effective choice of all the constantly evolving applications that might be required by the e-U. It may be that a subsidiary or partner of the e-U acts as an ASP to serve the e-U's requirements.

3 e-U operations

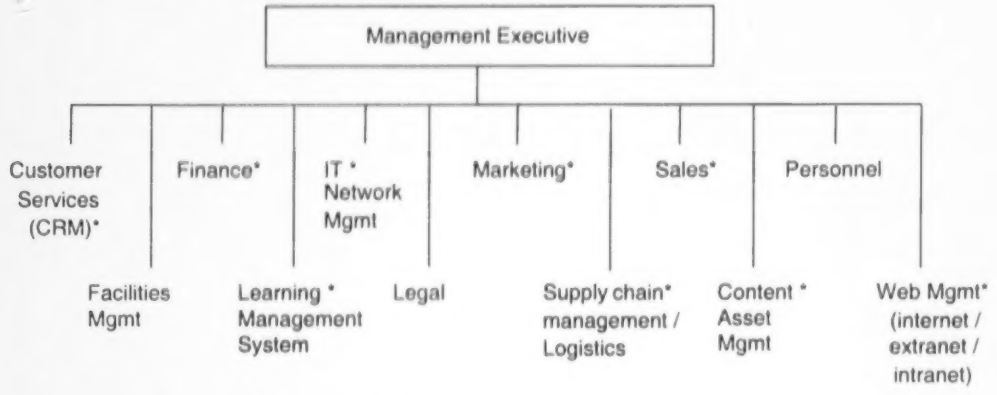
41. The e-U will be a new internet company starting from nothing and without legacy systems or business processes to affect its development. From a technology point of view, this will give the e-U a chance to be a truly innovative e-business with its operations based on a wholly web-oriented, open standards model.

Back office and customer facing administration

42. This section describes the main e-U administrative functions. Details are given of the back office operations and support systems, as well as the customer facing administrative functions.

e-U back office operations

43. Figure 3 below shows the main internal operational functions of the e-U. These are the back office operations that make up the e-U administration.



* indicates web-enabled applications available to support these activities

Figure 3 e-U Management Operations

44. It is envisaged that the e-U will employ web-enabled applications to support its management functions where possible (see later for more details). At present the following web-enabled applications are available:

- customer relationship management (CRM)
- finance and electronic billing systems
- IT network management systems
- marketing and sales
- supply chain management /e-procurement
- web management and web publishing.

45. There are also several enterprise software suppliers who would provide an entire suite of web-based applications.

46. The applications developed so far that take full advantage of the opportunities presented by the internet are marketing, sales, CRM and the internet-specific applications such as web publishing. CRM now has an enormous influence on e-business strategies, brought about mainly by the advent of the Web. We discuss it further in the section below.

47. In the near future, technology will develop sufficiently to allow access to the internet via a number of different channels. Today, most access is via a PC but it will not be long before users can access the internet via mobile telephones, interactive TV or even computer games consoles. The development of technology is discussed further in section 4 of this annex, but a point to note here is that the information relayed to the learner may need to be made available via different channels, including administrative information and transactions with the learner. One could imagine a student in the future picking up his exam results via his mobile telephone. Some administrative services will have to be redesigned, or repackaged, for access via new digital channels.

Customer Relationship Management (CRM)

48. CRM is the process to develop an accurate view of an organisation's customers. The goal of CRM is to know all the points at which customers interact with the organisation. With the use of internet technology and CRM applications it is now possible to build up a clear view of customers which allows strategic marketing or business initiatives to be more accurate. By offering timely incentives and product choices where and when the customer needs them most, an organisation can offer the best possible service to its customers. Excellent customer service helps an organisation to keep its customers happy, and ultimately grow its market, as satisfied customers are more likely to provide recommendations to others.

49. CRM gives clear information on actual customers, but business intelligence is required to analyse it in conjunction with other operational data to spot trends and develop business strategies accordingly.

50. The advent of the internet has brought about an explosion in CRM technologies as it is possible to track and record every transaction a customer, or partner, may have with an organisation. A customer's behaviour whilst visiting an internet site is easily monitored; call centres and other transactions can also now be logged in the central CRM database. This valuable information provides the driver for new business strategies and continuous improvement.

51. The e-U should take full advantage of the opportunity to build up a full picture of its customers, and use that information when making business decisions about investments in new materials and/or services. The e-U should also use CRM to improve its customer service to partner HEIs and others.

Customer facing administrative operations

52. The operations below are some of the administrative functions that involve direct interaction with the customer. The administrative functions of the e-U will need to interact directly with the Learning Management System, particularly for the exchange of data. A very brief description of the main technology aspects is given.

- **Registration** – on-line student enrolment, direct link to back office administrative functions.
- **Central services** – these are services such as the library which would be offered to all students irrespective of course, geographic location, etc (see Annex 3). Central library services are likely to be presented to students via an e-U portal that helps direct users to the information they require. (It is possible that the provision of central services will be outsourced to others and a link provided from the e-U home page.)
- **Payment** – typically on-line payment for learning programmes, with a direct link to back office administrative functions (especially billing and finance).
- **e-commerce** (including associated services) – typically includes on-line sales of books and other courseware, and sale of services such as travel and banking (these services will probably be provided by others but a link will be provided from the e-U web-site to their sites). The internally managed e-commerce facilities will have a direct link to fulfilment functions of the e-U.

53. Administrative systems specifically for learning institutions exist today and are developing rapidly. It is becoming more and more important for these systems to integrate with the LMS as well as other applications needed for the operation of the e-U. To this end,

standards are being developed to ensure greater interoperability between systems. Procurement of e-U technology systems is covered generally below. However, we note that further analysis of the functionality requirements of the e-U is required before any systems can be purchased.

Main characteristics of the e-U technical platform

54. The e-U platform will comprise the networks, hardware, software applications and interfaces with external systems that support the e-U operations. The following sections outline the main characteristics we would hope to see associated with the technology platform.

Integrated infrastructure

55. For any e-business to excel, its employees require fast, efficient support systems, and timely and accurate information to inform their decisions. It is important that the applications that underpin the operations of the e-U are able to exchange relevant information automatically and accurately. For instance, when a student registers or buys a learning module on-line, the navigator, sales, marketing and finance functions should have real-time access to that information. In order to do this, the infrastructure and applications themselves need to be well integrated to the point where they can exchange data which can be automatically interpreted without human intervention. Industry providers of software and hardware are currently trying to develop standards that will support a high level of integration. However, at present these standards are not universally applied and generally the interfaces between applications must be integrated using bespoke software solutions.

56. When selecting applications a conflict exists between choosing a single, proprietary supplier, and going with the best-of-breed application for each function. The mammoth Enterprise Resource Management systems able to integrate the entire operations of a company, and widely implemented in global companies throughout the 1990s, are often seen to be unwieldy and difficult to integrate with legacy or new systems. A best-of-breed approach, taking different applications from various suppliers, will generally require heavy integration input to achieve a smooth operation. The market for these applications has been demanding more easily interchangeable products, but so far the industry has gone only some way to achieving this.

57. Web-enabled applications, which employ browser technology and run using Internet Protocol (IP) over the internet, extranet or intranet, go a long way to enabling easy exchange of information, particularly over distributed networks. They are also able to interpret data which are gathered via the organisation's web-site. It is envisaged that almost all applications will be web-enabled before long and, because of the reasons above, we would suggest that the e-U selects internet-based applications over more conventional offerings. Currently the applications which are web-enabled tend to be those that directly use data gathered on customer web-sites such as marketing and finance. As companies use the internet for more and more of their operations (for example, the personnel department may use the internet for recruitment), more and more web-enabled applications will become available.

Flexibility

58. The e-U will need to demonstrate flexibility in its operations in order to react fast to its changing environment. This is particularly true for an internet start-up operating in a new

industry, where external forces may require the business to change on a regular basis. Consequently, the systems architecture which supports the operations will need to be just as agile in its response to change. The adoption of agreed standards by suppliers will make their products inherently more flexible by allowing modularity and the easy interchange of different products.

Scalability and growth

59. It is impossible to predict with any certainty how the e-U will develop once it is up and running. There are many variables which will affect the load on the office systems including numbers of students; number, size and packaging of modules offered; and volume of content available, including archived material. Therefore, just as the e-U will need to be flexible so that it can change its operations easily, it will also need to be readily scalable to cope with potentially rapidly increased demand.

Modernisation/upgrade

60. The e-U will need to be constantly reviewing its operations and associated technology systems in order to stay ahead of the competition. A process of continuous improvement will entail regular modernisation of its systems. So although the e-U will have the advantage of not having legacy systems to incorporate when it starts up, it will very quickly need to consider upgrading or replacing its various IT systems. The systems architecture should be designed to be flexible, so that modernisation can be much easier and cheaper.

Convergence

61. As the devices over which the learner will receive content develop (for example with the advent of wireless and interactive TV), the back office systems will also need to change. The e-U will need to provide services regardless of network type or customer channel.

Security and privacy

62. The e-U will need convincing security arrangements to ensure it has the trust of all the customers, and partners who use its systems. An overall security policy would include:

- an assessment of risk to the systems (including competitors trying to overload the e-U systems, credit card fraud, a hacker breaking into the server and altering customer records, etc)
- planning a proper security architecture
- developing general organisational policies involving employees to protect customer privacy.

63. Measures which can be taken against security risks include firewalls, digital certification and encryption. A firewall is a computer running on a modified operating system that isolates an organisation's internal network from the internet. It allows some connections to pass and blocks others; it is considered the first line of defence for security measures. A digital certificate is an electronic document that has been digitally signed by the issuer, similar to a paper document being signed in ink. Its function is to identify a person or an organisation on the internet. These could be used for learner identification for assessment purposes. Encryption supports secure payment over the internet using SSL (Secure Sockets Layer).

64. A further security issue of growing importance is privacy on the internet. Organisations should encourage a culture of respecting privacy to build the trust of their customers. In addition to using the above tools to ensure privacy of information it will be necessary for the e-U to consider the different legal considerations in different countries.

Availability and reliability

65. To ensure the reliability and availability of the e-U's back office systems, care must be taken in the initial design to ensure sufficient capacity. After initial design, testing and commissioning to get the system up and running it will continue to grow in scale, complexity and basic value as the variety of available equipment and services within it expands. As the e-U network will be distributed, rather than established on a centralised computing platform, it will be more vulnerable to network failures, which could occur on real circuits, software or hardware. Network management systems feature sophisticated tools such as visually-aided fault detection. Their main purpose is to ensure network availability. Network management involves other tasks as well. Many network problems arise not from dramatic strikes of lightning or sudden equipment failure but from gradual erosions of performance that could be detected well in advance if proper procedures had been deployed. Therefore network management must concentrate on monitoring and maintenance, as well as responding to emergency failures.

Standards

66. Existing and new standards are being developed across all components of systems including infrastructure hardware, software and networks. If standards are designed with the end user in mind they will enable systems to be more easily integrated, more flexible and scalable, and more easily upgraded. They will also allow the customer to select the best product to suit his or her requirements. However, a standard will only be effective if it is accepted both by the users and by suppliers themselves. The e-U should be aware of the development of standards to ensure the platform it chooses is compliant and therefore more adaptable to changing future requirements.

67. One example, the Business and Accounting Software Developers Association (BASDA) developed the electronic Business Interchange Standard (eBIS) in early 1999 to determine the best way for applications to be directly linked. eBIS uses XML messages sent by e-mail to do this. It is intended that eBIS should replace Electronic Data Interchange (EDI) which requires expensive configuration and proprietary delivery mechanisms.

Partner operations based on the extranet

68. For the smooth and efficient administration of the e-U it is vital that content providers, providers of student support services and supporting areas (such as libraries) be linked to the e-U by an 'e-U extranet'. This would be the vehicle for communication between the e-U and its partner institutions and organisations.

69. An extranet is similar to a corporate intranet. However it enables multiple organisations to access private information from each of the organisation's internal networks via the public internet. It supports the same protocols and services as the public internet, including e-mail, news, chat rooms and web pages. The extranet would provide access to internal 'group' information whilst also securing other data from partners on a selective basis (for example, it will not let one partner access billing information about another partner).

70. The extranet should be used for functions such as:

- billing and invoicing
- marketing functions
- on-line tendering
- exchange of student information
- course information
- e-U resources for partners
- knowledge management.

Network

71. We would expect the majority of the information to be shared would be hosted by the e-U regardless of originator. All parties would access this information via their normal method of accessing the internet.

72. The major technology issues for network extranets are security and interoperability. Standards for users of the internet will assist in ensuring security and interoperability, and to this end the Internet Engineering Task Force (IETF) has been established. The IETF is a large, open international community of network designers, operators, vendors and researchers whose purpose is to co-ordinate the operation, management and evolution of the internet and to resolve short- and mid-range protocol and architectural issues. It is a major source of proposals for protocol standards which are submitted to the Internet Architecture Board (IAB) for final approval.

73. In the case of HEIs, many of these are already linked (to the internet and each other) by JANET, a Virtual Private Network (VPN) which uses carrier-provided networks but which functions as a private network. The primary service already delivered over JANET is IP (Internet Protocol). See later in this section for more information about JANET.

74. Each organisation would require an extranet router at the edge of its network. Routers are the interconnection points between the internal networks and the extranet itself and would provide a point for security and control.

75. Security functions are performed on IP packets by the router, which are then encapsulated, or tunnelled, inside other IP packets for routing across the internet. There are a number of protocols which are used to implement IP VPNs: Point to Point Tunnelling Protocol (PPTP), Layer 2 Forwarding (L2F), L2TP, and IPSec. IPSec has the advantage that it provides security on a packet by packet basis. The limitation is that it only carries IP packets and not other protocols (such as IPX and Appletalk).

Interoperability

76. The interoperability of the various networks which would make up the extranet would be key to its success. Many parts of each of the networks involved must interoperate.

77. Netscape is leading a consortium of companies in the support of a set of extranet standards to create a comprehensive, interoperable infrastructure for the secure transmission of information. The standards cover directory services, encryption and authentication and formats for the exchange of information.

Network security

78. Routers will be required by each organisation as the interconnection points between individual networks. Extranet routers also include security features which would provide all parties with secure links.

79. Access to data can be controlled and managed through strategies including IDs, passwords and encryption.

JANET and SuperJANET4 – the academic network

80. JANET is the Joint Academic Network. It comprises physical infrastructure that connects all higher education institutions, Research Council sites, further education colleges and other bodies with an interest in working with the HE and research community. The JANET network provides a very fast and secure route for information to be relayed between HE organisations. It does not provide the applications and servers to support the operations of those organisations; these are held on a local area network (LAN) dedicated to the organisation.

81. Currently, the SuperJANET3 network offers high connection data rates between 18 major HE sites in the country. Connection rates for these sites range from 34Mbits/s to 155Mbits/s. The remaining HEIs are also connected into the network although generally at lower speeds.

82. In June 2000 it was announced that the JANET network and infrastructure are to be upgraded to enhance service and increase capacity. The new SuperJANET4 will connect over 700 sites across the UK and provide very fast internet access speeds for all users. Although SuperJANET4 will not be complete for 5 years or so, the interim improvements will be considerable. The minimum link to the main HEI nodes of the network will be 155Mbits/s and the maximum will be 2.5 Gbits/s.

83. As mentioned previously, it is possible that communication and transfer of information between the e-U and the HEIs may be carried out over the SuperJANET network. It is possible that non-HE e-U partners may also be able to link to SuperJANET subject to satisfying membership requirements. It would appear that the network does have sufficient capacity to handle e-U requirements if desired. The advantages of SuperJANET would be that it offers fast and secure connections between parties and also to the internet, and would obviate the need for HEIs to upgrade existing connections to the internet. The alternative would be simply to operate an extranet over the internet. However, use of the public network is likely to be more costly and slow if the same connection speeds are to be achieved.

84. When considering the capacity of the JANET network, the main factors are the type of applications or data to be transmitted, and the maximum demand, or number of simultaneous users. Early e-U traffic will typically comprise documents, images and downloadable video and audio; other material would include live streaming of audio and video material (which requires very high data rates), and interactive whiteboard and other collaboration tools. SuperJANET4 will probably have the capacity even to deliver the live streaming of audio and video at an adequate quality.

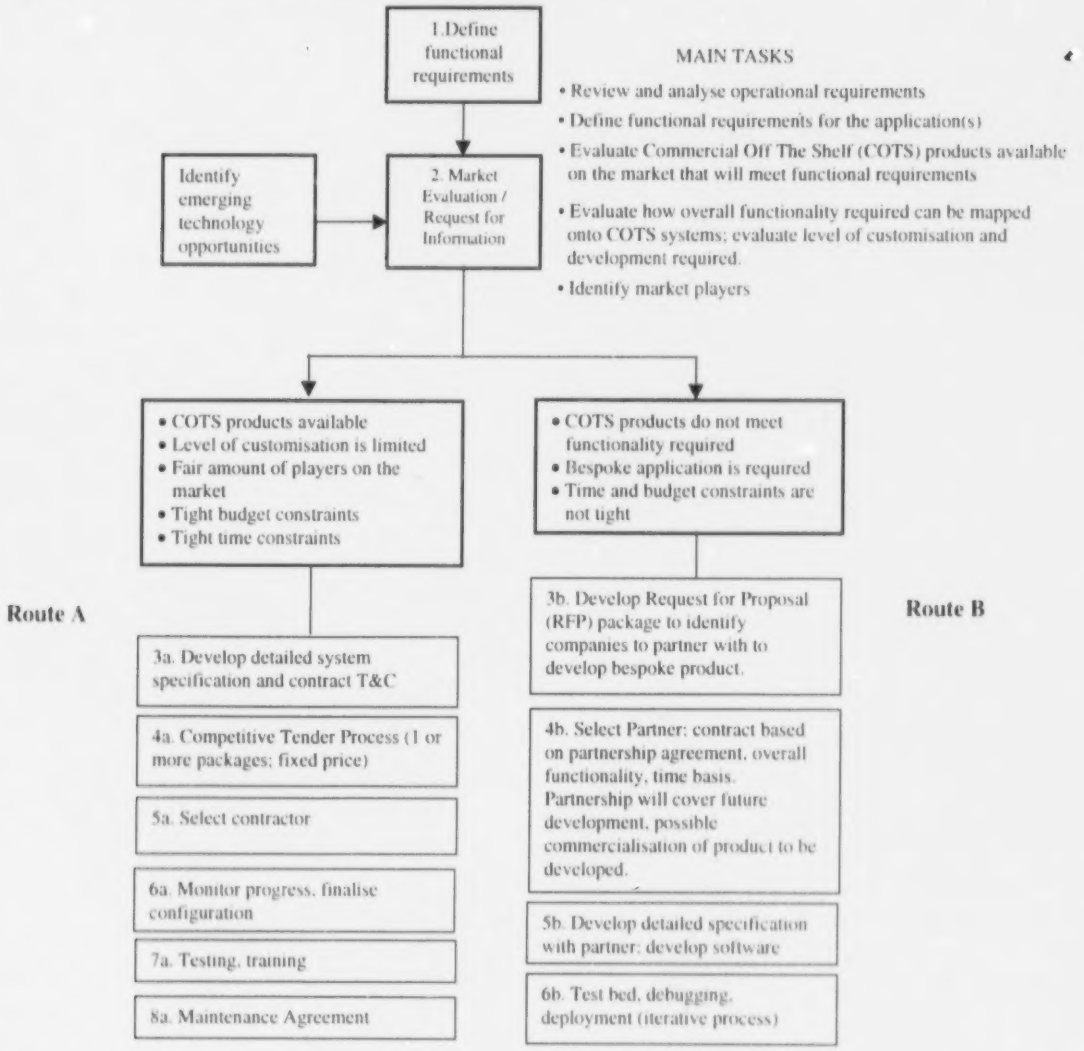
85. The software used in e-learning applications is still developing, and higher data rates or better quality information may be required in the future. However, we would expect the UK's education network to keep up with demand trends and be able to support the evolution of e-learning requirements.

Procurement of technology platform

86. Procurement of software applications requires effective co-ordination of the applications and all other aspects of the communications infrastructure such as networks, LANs and WANs, cabling infrastructure and building IT infrastructure.

87. In this section we outline the two main routes for procurement of the e-U technology platform and the factors to be considered to ensure an effective procurement process and successful implementation. Table 1 shows the main steps.

Table 1 Procurement of the e-U technology platform


1.Define functional requirements
MAIN TASKS
• Review and analyse operational requirements
• Define functional requirements for the application(s)
• Evaluate Commercial Off The Shelf (COTS) products available on the market that will meet functional requirements
• Evaluate how overall functionality required can be mapped onto COTS systems; evaluate level of customisation and development required.
• Identify market players
Identify emerging technology opportunities
2. Market Evaluation / Request for Information
• COTS products available
• Level of customisation is limited
• Fair amount of players on the market
• Tight budget constraints
• Tight time constraints
• COTS products do not meet functionality required
• Bespoke application is required
• Time and budget constraints are not tight
Route A
Route B
3a. Develop detailed system specification and contract T&C
4a. Competitive Tender Process (1 or more packages; fixed price)
5a. Select contractor
6a. Monitor progress, finalise configuration
7a. Testing, training
8a. Maintenance Agreement
3b. Develop Request for Proposal (RFP) package to identify companies to partner with to develop bespoke product.
4b. Select Partner; contract based on partnership agreement, overall functionality, time basis. Partnership will cover future development, possible commercialisation of product to be developed.
5b. Develop detailed specification with partner; develop software
6b. Test bed, debugging, deployment (iterative process)

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88. After the major task of defining the operational and functional requirements of the system, there are two main routes for IT procurement. The first, Route A, would be to base the systems on commercial, off-the-shelf products. This is clearly only possible if they are available. The second, Route B, would be to commission a systems integrator to create a bespoke application. This would be done even if off-the-shelf products were available but did not meet the required functionality. More details about the two options are given below.

Route A

89. Route A generally limits the buyer's risk in terms of cost and time required to implement the solution. Our experience shows that costs can be reduced by more than 50 per cent if Route A can be accepted.

90. Route A would also offer greater flexibility for the e-U in terms of future developments and maintenance. COTS products would typically be updated by the vendor, and new versions offered at no cost as part of the maintenance contract. Future developments would be carried out at less cost for the customer, as these also benefit other customers. As a result development costs and maintenance cost are 'shared'.

91. Route A still allows for a modular approach, whereby different functions could be fulfilled by different COTS software. In this case, integration is required between systems, and middleware may be required to develop electronic interfaces. An advantage of this solution would be to allow the e-U to 'unplug' a sub-system at a later date and replace it with a new system from another supplier as new products become available on the market. However, it would be important to define interface requirements tightly, and ensure that all systems were based on open standards, with each interface documented in detail. As interface standards are becoming more and more advanced, this type of development becomes more cost effective and less risky.

92. The system specification and tender package would need to cover the following issues:

- functional requirements
- technical specification
- resilience, performance requirements
- terms and conditions
- interface specification
- contractors' responsibilities in developing interfaces
- maintenance requirements, service level agreement
- modernisation and adaptability to it and business change
- integration of third party systems through mergers and acquisitions.

Route B

93. Route B would provide the e-U with a bespoke application, which would fulfill its specific requirements. Although this approach can be required for very specific businesses – or to provide a business advantage over the competition – it would require more effort on the part of the e-U and the software developer partner(s) to specify the detailed functional

requirements and architecture for the system. Development time and testing of the product would also be longer.

94. In Route B the e-U would be required to work very closely with the developer, and continue the relationship with the developer in the long term, as and when the software has to be maintained and modified.

95. If such a solution were required, the e-U, in order to limit risk and cost, might try to enter a partnership agreement with the developer to commercialise the product at a later date.

E-U technology procurement

96. The e-U technology platform will be a very large, unusual and complex entity. It is unlikely that an off-the-shelf product already exists which would offer all the functionality and capability required. It is more likely that the e-U will require a bespoke solution for its technology platform, although the potential benefits of a tailored solution may be offset by the attendant costs and time for development. However, the e-U may well be able to use off-the-shelf products for some more common functions such as e-commerce, finance, etc. In addition, the e-U will want to use the best-of-breed learning applications for specific operations. All of these off-the-shelf products would still require considerable effort to tailor them for the e-U's particular requirements and to integrate them with the rest of the system.

4 Internet trends

97. In the next few years, access to the internet will be offered via a greater choice of channels and a choice of devices such as mobile handsets, TV boxes or game consoles as well as traditional PCs. This will have significant implications in terms of internet applications. Some of the devices will be more suitable for delivery of certain types of services than others and it is therefore likely that devices will become more application-specific.

98. The use of different devices and the development of networks and applications will give the e-U the opportunity to deliver learning products to students according to their personal preferences, skills and training. In parallel with technological advances, regulatory and infrastructure developments also affect the uptake of the internet as well as public perception of new technologies. The development of some channels for the internet, such as satellite, will allow individuals to access the internet independently, thereby rendering them less dependent on their country's infrastructure.

99. This section includes a review of existing and future technologies for the provision of access to the internet. It also looks at how regulations, standards and infrastructure will affect the development of the internet and advanced technology services world-wide.

Present and future technologies for internet access

Traditional technologies

100. Currently customers commonly access the internet through a PC, using dial-up services over a Public Switched Telephone Network (PSTN). Users access the internet via a dial-up connection or Asynchronous Digital Subscriber Lines (ADSL) at home, or via Integrated Services Digital Network (ISDN) or a leased line at work. The call is conveyed from the customer premises to the Internet Service Provider via the PSTN networks of originating and

terminating operators. A diagram showing current dial-up internet access services is given in Figure 4.

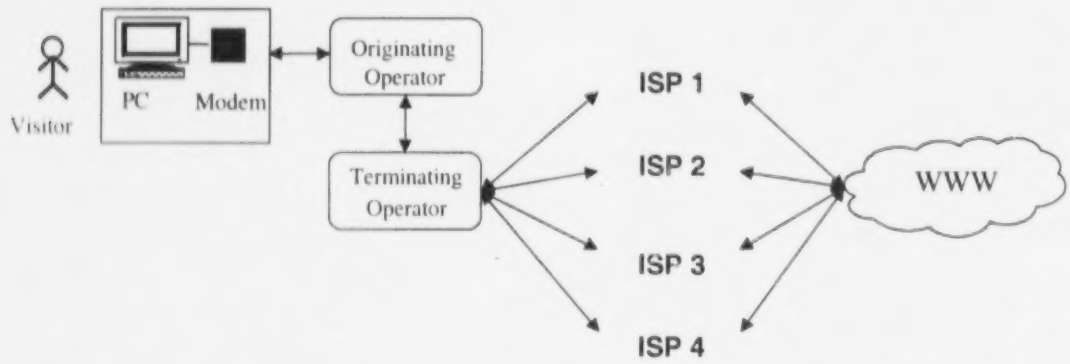

Figure 4 Dial-up connection via the PSTN to multiple ISPs

101. However, PSTN was designed for narrow bandwidth voice services that involve relatively small amounts of transmission data. Consequently PSTN cannot support the high bandwidth data transmission required for the provision of sophisticated internet services. Over the past six years, local access technologies have improved in the UK in terms of the amount of data transmission they can support. In 1995, the modem standard was 14.4Kbits/s but only a year later it doubled to 28.8 Kbits/second. By 1998 it had reached a rate of 56.7 Kbits/s (43 Kbits/s on average). However local access remains too slow to deliver high speed internet access, video-on-demand or interactive services via PCs or other devices.

Future customer channels and technologies for higher bandwidth services

102. In order to achieve higher bandwidth to access the internet it is necessary to upgrade the final link to the customer, or the 'last mile'; the core networks have adequate capability already. Over the next few years we shall see the introduction of new technologies such as Digital Subscriber Line (DSL), cable modems, third generation mobile (3G), broadband fixed wireless access, and satellite. Coupled with alternative devices (such as Wireless Application Protocol – WAP – enabled mobile handsets), these will be able to provide higher bandwidth and more sophisticated services.

103. Table 2 compares different local access technologies for the provision of internet services in terms of devices, access bit-rate, services delivered and when they are likely to be available in the UK.

Table 2 Alternative access technology for the provision of internet services

	Techno-Logy	Device	Local access bandwidth (actual)	Type of service	When first available in the UK
Tele - phone network	PSTN	PCs	Up to 56 Kbits/s	Internet dial-up e-mails	Currently available
↓	ISDN-2	PC	128 Kbits/s – 2 Mbits/s	Internet dial-up e-mails	Currently available
Wireless mobile	GSM	GSM mobile	Up to 9.6 Kbits/s	Basic web pages slow speed	Currently available
↓	GPRS	GPRS mobile	Up to 56 Kbits/s	Wireless internet services, location based applications	Currently available
	EDGE	EDGE compatible mobile	Up to 192Kbit/s	Wireless internet service; download of high quality picture; location based applications	2001
	3G/UMTS	UMTS enabled mobile handset	Min 384 Kbits/s for stationary terminals. Less for moving terminal	High speed access to the internet, interactive services, video – conferences, m-commerce , other services	2001 - 2002
Fixed Wireless ↓	Satellite	Satellite enabled mobile and PCs	Up to 2 Mbits/s	Internet services with lower performance than terrestrial / submarine links, also costly. Suitable for remote areas	Currently available
	Broadband WLL	Telephone, PC, TV set boxes	Around 5 Mbit/s	High speed access to internet and interactive services	Future (already in US)
Fixed ↓	Cable modems	TV set boxes PCs	Up to 27 Mbits/s downstream. 10Mbits/s upstream	Fast, 'always on' connection to internet and high quality on-line services	Currently available
	ADSL	PC	Up to 8Mbits/s downstream and up to 1 Mbits/s upstream.	Internet access, multimedia access, video-on-demand, home shopping	Currently available (recently introduced)

104. Interactive services via TV and mobile phones are already available, although still in a relatively primitive form. For instance, interactive services and e-mail are offered via digital satellite; virtual shopping malls and e-mails are available via digital TV cable.

105. It is anticipated that technology will develop to provide higher speeds and more sophisticated interactive services via a host of different devices such as WAP-enabled mobile phones, interactive TV and specially modified games consoles. However, the general level of technology currently available would require that, if it were to launch today, almost all e-U

activities would be designed for delivery over a PC. Connection to the internet could be by PSTN telephone, GSM wireless, cable or satellite depending on the learner's location.

Wireless

106. WAP is currently one of the leading protocols for wireless connection to the internet. It is a licence-free protocol that enables internet pages to be read from a mobile phone using Wireless Mark-up Language, the mobile equivalent of HTTP (HyperText Transfer Protocol) on the internet. It is predicted that WAP will eventually evolve for use with the future wireless technology, UMTS 3G mobile technology.

107. Wireless technology will evolve in phases. Between WAP mobile and UMTS 3G mobile commercialisation, two intermediate services may operate in the market: the GPRS (General Packet Radio Service), and the EDGE (Enhanced Data Rates for GSM Evolution) services. In parallel, satellite, cable modem, xDSL and broadband WLL technologies will develop to generate operational services with equivalent functionality. These are explained below.

- **GPRS – General Packet Radio Service.** This is the first phase in transforming the GSM network into 3G functionality. The GPRS's packet-switched technology allows more efficient use of the spectrum. It will double the speed of mobile internet access to 115 Kbits/second, and will be an 'always on' technology, that is it will no longer require dial-up calls due to the use of packet technology.

  GPRS is able to provide location-based applications. Mobile phone companies are able to locate roughly where their customers are at any time of the day. They will be able to do this more and more precisely as the geopositioning technology becomes more sophisticated. This may have a significant impact on future businesses, with the creation of new services which have not even been considered so far. However, the major issue surrounding location-based services concerns the general public's privacy and security.

- **EDGE – Enhanced Data-rates for GSM Evolution.** EDGE technology represents a further step towards 3G UMTS mobile. Similar to GPRS, EDGE is a packet switched technology and will enable operators to optimise their use of frequencies. It will offer higher data rates up to 384 Kbits/s, although in practice data rates of 96 Kbits/s and 192 Kbits/s are more likely. The increasing bandwidth will enable EDGE to offer more advanced services than GPRS. In addition to higher speed access to the internet via mobile handsets and location-based applications, EDGE will offer high quality images and video.

- **3G – Third Generation mobile**. Unlike second generation mobile, 3G will be a unique global standard to offer converged services at an international level. The International Telecommunications Union (ITU) is working towards a global standard, offering seamless global roaming (to receive and make phone calls anywhere in the world without changing either number or handset), and high transmission rates (maximum speed of 2 Mbits/s for a stationary terminal and 348 Kbits/s for a moving one).

  The broadband capacity of 3G mobile will enable development of a wide range of services not available today via mobile handsets. 3G mobile will offer internet access and graphical content interactive services. This will include video-conferencing, video telephony, real time video content and mobile commerce. Its

technology is sophisticated enough to become a potential platform for e-learning services delivery.

In the next five years, most of Europe, Asia and the US will have access to 3G, but the future of 3G in Central and South America is currently uncertain.

Satellite

108. Satellite systems are mainly used to access the internet in remote areas where no alternative technology is available. A constellation of satellites enables operators to provide services over a large geographical area. Satellite systems are classified according to the orbital altitude they inhabit: geostationary (GEO), low earth orbit (LEO) and medium earth orbit (MEO). GEO systems use satellites situated some 36,000 km above the equator, each of them having a coverage area of 45 per cent of the globe. So far this system has primarily been used to provide voice and data communications, as well as TV, video, and audio broadcast services. Satellite services are being developed to offer internet access, but at present this is still relatively slow and expensive.

109. Mobile satellite services will become a viable solution only through LEO and MEO systems. LEO systems use non-fixed satellites at approximately 450 to 1,000 km above the earth; but unlike MEO, which are at 15,000 km, they require a large number of satellites (a minimum of 48 to 77) to offer global coverage. MEO systems have been specially designed to provide global coverage of communication services and require only 9 to 12 satellites. It is likely that the MEO service will be operable in the near future.

Cable modems

110. In parallel with wireless technology, the development of cable modem and CATV infrastructure provides improved access speeds to the internet. Cable modems are external devices connected to PCs. They convert digital signals to and from a radio frequency channel, which enables internet traffic to be conveyed via CATV infrastructure. Cable modems increase access speeds up to 27 Mbits/s downstream and up to 500 Kbit/s to 10 Mbits/s upstream.

111. Cable modems are shared amongst users through neighbourhood network nodes or a corporate remote LAN network. The performance of the service depends on the number of users that are simultaneously connected: the more simultaneous users the slower the access speed.

112. Two international standards have emerged for cable modems which are not interoperable: DOCSIS (Data Over Cable Service Interface Specification) in North America and other international networks, and DVB/DAVIC (Digital Audio Video Council) in Europe.

113. The use of cable modem requires CATV networks to be upgraded to enable two-way transmissions. Cable network providers are currently implementing widespread upgrades to their networks. The development of interoperable cable modem standards should boost the use of this technology as an alternative channel for accessing the internet.

Digital Subscriber Line (DSL)

114. xDSL technology involves the upgrading of the existing copper wire telephone line connection to permit the transmission of higher bandwidth at the local end. As part of xDSL technologies, asynchronous (ADSL) is the most sophisticated technology that can be used for

internet access, multimedia access, video on demand, and e-commerce. It is an asymmetric technology, which enables transmission of information to and from remote offices at speeds over 60 times faster than ISDN. ADSL offers data transmission rates/of up to 8 Mbits/s downstream and up to 1 Mbit/s upstream.

Broadband Wireless Local Loop (WLL)

115. Wireless Local Loop, also known as Fixed Wireless Access (FWA), is the technology that uses wireless links from the customer's premises to the local exchange for the provision of voice telephony and data transmission services. WLL technology can be broadband or narrowband. Broadband WLL enables access to Internet Protocol (IP) networks and therefore access to the internet. This technology is suitable in areas where the terrain and the telecommunications development make the installation of traditional services less attractive or less cost-effective. Although WLL is not common in the UK, it is proving a popular technology in the US, and will be very suitable in areas such as South America and some parts of Asia where the existing telecommunications infrastructure is undeveloped, particularly over the 'last mile'.

Voice over IP

116. Finally, although standards for voice over IP are still very undeveloped, the current low quality of voice transmission it offers makes it hard to see the benefits for the e-U of this latest technology. Voice over IP transmits voice telephony as packets over an IP network. Although the technology is still in its early stages, voice over IP is unlikely to match the quality of service of voice telephony transmission currently available over circuit switched networks. This is because IP networks are specially designed for data transmission. When packets of data are transmitted over IP networks, some packets can be lost or delayed during the transmission. This does not have significant impact on traditional data transmission, but would definitely be unacceptable for voice telephony services.

Status of local access technology around the world

117. Despite ITU objectives to develop a unique global standard for 3G mobile, the reality is that regulation and competition are not internationally uniform. The time scale for adoption of advanced technologies is likely to vary according to geographical location. The lack of regulatory uniformity may slow the implementation of new technologies in less developed countries unsure of which technology to adopt. This will limit local access bandwidth availability and international connectivity to internet backbone in particular geographical locations.

Europe

118. In Europe, the UK is one of the countries taking the lead in implementing advanced technologies for local access. Basic WAP services, such as a mobile banking service, are already available in the UK and in some other European countries.

119. The upgrading of GSM technology to support 3G networks has already started in the UK. British Telecom (BT Cellnet) announced at the end of June 2000 the launch of the world's first GPRS service and GPRS-based application. The service, initially only available to the corporate market, will enable mobile access to corporate networks. It will allow users to access the web and scheduler information, and to pick up e-mails. It is expected that GPRS

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services will spread over other market sectors in the coming months, targeting specific groups of workers.

120. In parallel with technology advances, efforts are being made to resolve regulatory issues ahead of the introduction of 3G mobile in Europe. Recommendations from the European Union to finalise licensing of Universal Mobile Telecommunications Systems (UMTS) by the end of 1999 and to launch the service by 1 January 2002, have put pressure on EU members to go ahead with the 3G mobile implementation process. After Finland, the United Kingdom was one of the first countries in the world to license 3G mobile operators. The auction, held in early 2000, allocated five licences authorising the operation of 3G mobile services from 2002. Licensing of UMTS in other European countries is following.

121. Finally, the development of the regulatory environment in Europe should help businesses to develop multi-channel delivery of higher bandwidth services. For example, OFTEL (UK's regulatory telecommunications authority) announced that BT will be required to offer unbundled local loop to third party service providers from 1 July 2001. Access to the local loop will enable BT's competitors to offer access to the internet via ADSL technology. Similar rulings are expected for cable operators. OFTEL is currently considering whether cable network providers have excessive market power and therefore should be submitted to regulatory access open controls.

United States

122. In the US, ISDN technology is widely used as a means to access the internet; this is expected to continue for the next few years. However, alternative channels are also developing. Fixed broadband wireless services are currently offered at the 24GHz, 28GHz, and 38GHz bandwidth by various companies for the provision of internet access, high speed data transmission and videoconferencing services.

123. Other higher speed services such as Local Multipoint Distribution Service (LMDS) and Multichannel Multipoint Distribution Service (MMDS) are currently available and are becoming more widespread. As of early 1999, MMDS services (for high-speed internet access and wireless TV) were available (either commercially or in trials) in 18 states and accounted for about 1 million wireless cable subscribers.

124. Third generation mobile is expected to be available in North America from 2002.

Asia Pacific

125. In Asia Pacific, the most developed countries are building broadband networks to offer high speed voice, data and video services. These include Australia, Hong Kong, Japan, Singapore, and South Korea. Interactive multimedia services are already provided in most industrialised Asian countries through the use of ADSL and cable modems.

126. Japan is currently competing with European countries to be the first to commercialise 3G mobile services. Japan plans to launch its 3G mobile system in early 2001 (NTT Docomo previously launched its i.mode packet service in February 1999 in Japan).

127. In countries such as China, India and the Philippines, where rural areas are facing bottlenecks over the last mile of connectivity, WLL is expected to provide the solution.

Rest of the world

128. The global adaptation of internet technologies and e-business has further enhanced the availability of public internet access through traditional telecommunications services. As outlined earlier, this has now led to the development of broadband services with the aim to increase speed of access and quality of service. China, India and Brazil are following this trend and will increase the availability of high quality internet access as a response to growing user demand and market pressures. The e-U will act as a smart follower according to local service level available.

129. In Latin America, the current infrastructure remains generally quite poor, although it is better in South than in Central America. International connectivity to the internet predominantly relies on low capacity satellite links. However, with the arrival of foreign investment in the region (a large number of countries have now privatised their incumbent operator), new technologies are likely to be introduced to improve the local infrastructure.

130. Some analysts forecast that Latin America may be one of the regions with the most advanced technology infrastructure in the future. Anticipated changes include increased digitisation of the network, expansion of the fixed wireless access network, development of the data communications infrastructure based on IP protocol, and the introduction of integrated services such as fixed-mobile and cable telephony (based on cable television networks). International and intra-regional capacity is also expected to expand, with the deployment of submarine cables between the US and Mexico and neighbouring countries. Intra-regional networks already exist between Brazil and Argentina.

131. In Africa, network deployment for data transmission services is very limited. Apart from South Africa, African countries currently have very basic data transmission services. At the end of 1999, South Africa, Morocco and Tunisia were the only three African countries with connections to the internet at more than 10 Mbits/s. The chances are that, in the coming years, satellite technology will be deployed in African markets as a means to access the internet.

132. Satellite has been the technology chosen in several African countries for the provision of cellular and broadcast services. In October last year the launch of WorldSpace satellite broadcasting services across almost the entire African continent paved the way for the introduction of satellite systems and enabled the delivery of multimedia applications such as high speed internet, e-commerce, video conferencing and interactive entertainment. Despite the fact that satellite performance lags behind terrestrial links, this is the trend expected in most developing countries under-served by terrestrial or submarine cables. This is because most of the population is rural, and national demand for high bandwidth is not a priority.

133. SkyBridge LP, a company led by Alcatel, is currently developing an 80 LEO satellite constellation system that will offer combined broadband and narrowband services for business and residential users anywhere in the world. The service is due to be launched in 2002 and is seen as a promising solution for offering a potential universal channel for the delivery of high bandwidth services.

Development of international internet architecture

134. For historical reasons, the internet transmission facilities are concentrated in the US, making it the hub through which all international traffic passes. Intra-regional traffic in

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Europe for example is mainly routed via the US. The trace route for world internet traffic is not dependent on distance but is based on time efficiency: because long haul cables offer higher transmission capacity, they deliver information packets in a shorter time than low capacity cables on a shorter route.

135. The location of Domain Name System (DNS) databases also explains why the internet has developed according to a US-centric typology. The DNS databases are stored in 13 root servers, only three of which are situated outside the US (in Tokyo, London and Stockholm). DNS database information can be accessed locally as Internet Service Providers store copies of it in their servers. But the information has to be updated on the root servers every two to three days, generating traffic to the US.

136. The US-centric internet backbone architecture is starting to diffuse, thanks to regulatory development in the rest of the world. Western Europe and East Asia are becoming secondary internet hubs as regulatory reforms have helped to drive down the cost of a local internet backbone. Increasing competition in European and Asian telecommunication sectors has reduced the costs of local regional long distance circuits. However, in less developed areas, intra-region links have grown more slowly because of the remaining monopoly environment and poor local infrastructure.

137. Figure 5 shows the availability of inter-regional internet bandwidth in 1999. Domestic backbone routes are not included.

Figure 5 Inter-regional internet bandwidth, 1999

Source: 'Hubs and Spokes', TeleGeography, 2000.

138. Despite low bandwidth international connectivity in Africa and Latin America, whether or not (and how quickly) advanced services are commercialised in these regions depends more on the regulatory development than on technical factors. Indeed, if national

governments authorise competition to develop, investment in local networks will increase and new technologies will roll out. In the past, and where regulatory development permitted it, internet backbones have developed in line with demand.

Development of Internet Service Providers (ISP)

139. An Internet Service Provider (ISP) provides its customers with access to the internet, generally via a PC. Customers usually visit the ISP homepage automatically, every time they log on to the internet. Figure 4 shows how individuals typically gain access to the internet.

140. There are currently two models: the first is a pure ISP which owns the technical infrastructure backbone required to offer the service. The second model is a Virtual Internet Service Provider (V-ISP) which leases the use of the technical infrastructure from an ISP but still maintains the direct contact with the customer.

141. Currently in the UK, ISPs and V-ISPs, especially those offering a free service, generate revenues by taking a portion of telephone call charges. ISPs sometimes charge for internet access but they are able to offer superior services which are more reliable and sophisticated. The main ISP/V-ISPs in the UK are FreeServe, BT, AOL UK, Virgin, Compuserve, Tesco Net and Demon Net.

142. In other countries, particularly the US, there has been a move towards a flat rate subscription model. Currently many European businesses are exerting great pressure on OFTEL, and other telecom regulatory bodies, to move to this model. (Some UK ISPs have already started to introduce flat rate payment, which, unsurprisingly, has proved popular with customers.) ISP/V-ISP revenues generated from the subscription charges, which will probably be lower in total than call charge shares, will now need to be supplemented by e-commerce activities and advertising.

143. It is anticipated that, whilst ISPs will be able to protect their business, V-ISPs will find it much harder to be commercially viable and many will disappear. The only alternative for V-ISPs is to develop and strengthen their customer base by offering more value-adding services. Furthermore, technology trends will almost certainly mean greater demand for bandwidth both from businesses and home users. Because of their reliance on the network operators, a V-ISP's survival will depend on its ability to negotiate good commercial agreements with ISPs offering speedy internet access.

144. The e-U may consider becoming its own V-ISP to provide internet access to its students and partners. It is unlikely that the e-U would become an ISP because of the huge investment required to provide the technology infrastructure – a whole different business. The potential benefits for the e-U would be that it could:

- generate additional revenue
- develop and strengthen relationships with customers (a subscription model would mean having an ongoing billing relationship with customers).

145. However, there would be a risk that the V-ISP would not be able to generate sufficient revenues with a flat rate subscription model. External market forces and technology changes outside the control of the e-U would also have an impact on the success of such a venture. Furthermore, different countries have different requirements from an ISP which may make it a very complex and difficult operation to establish and run across many geographic locations (although the e-U could restrict its offering to certain countries).

146. If the e-U were to establish an ISP service for its target markets (likely to be students and partner organisations) it could offer specific services such as free e-mail or alumni services. Students of the e-U will need internet access anyway and it would be convenient for them to bundle in internet subscription charges with course fees. The e-U V-ISP could offer access to the internet via a number of different channels as the e-learning technology develops. This could differentiate the e-U's offering from other service providers.

147. The business model for an e-U V-ISP would need to be considered carefully before implementation, particularly in view of the predicted technology changes and the difficulties of offering such a service across many different countries. It may be that a subsidiary or partner operation(s) could offer the service in partnership with the e-U. The next steps for the e-U are to investigate ISP current and future predicted markets and technology providers in target e-U countries. If there seems to be a good business case a business plan should be developed for an e-U V-ISP. However, in our view it is probable that the e-U will either leave the provision of internet access to local providers, or it will partner with others to act as a V-ISP.

Acronyms

3G	Third Generation
ADL	Advanced Distributed Learning
ADSL	Asynchronous Digital Subscriber Line
AICC	Aviation Industry CBT Committee
ASP	Application Service Provider
CMC	Computer Mediated Conference (or Collaboration)
CMI	Computer Managed Instruction
COTS	Commercial Off the Shelf
CPD	Continuing Professional Development
CRM	Customer Relationship Management
CVCP	Committee of Vice-chancellors and Principals
DNS	Domain Name System
DSL	Digital Subscriber Line
eBIS	Electronic Business Interchange Standard
EDGE	Enhanced Data-rates for GSM Evolution
EDI	Electronic Data Interchange
GEO	Geostationary
GPRS	General Packet Radio Service
GSM	Groupe Speciale Mobile
HEI	Higher Education Institution
IEEE	Institution of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IMS	Instructional Management Project
IP	Internet Protocol
IPR	Intellectual Property Rights
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
JANET	Joint Academic Network
LAN	Local Area Network
LEO	Low Earth Orbit
LMS	Learning Management System
LTSC	Learning Technology Standards Committee
LTSN	Learning and Teaching Support Network
MEO	Medium Earth Orbit
MMDS	Multichannel Multipoint Distribution Service
PSTN	Public Switched Telephone Network
SCORM	Shareable Courseware Object Reference Model
UfI	University for Industry
UMTS	Universal Mobile Telecommunications Systems
V-ISP	Virtual Internet Service Provider
VPN	Virtual Private Network
WAN	Wide Area Network
WAP	Wireless Application Protocol
WLL	Wireless Local Loop
XML	Extensible Mark-up Language

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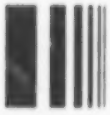

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